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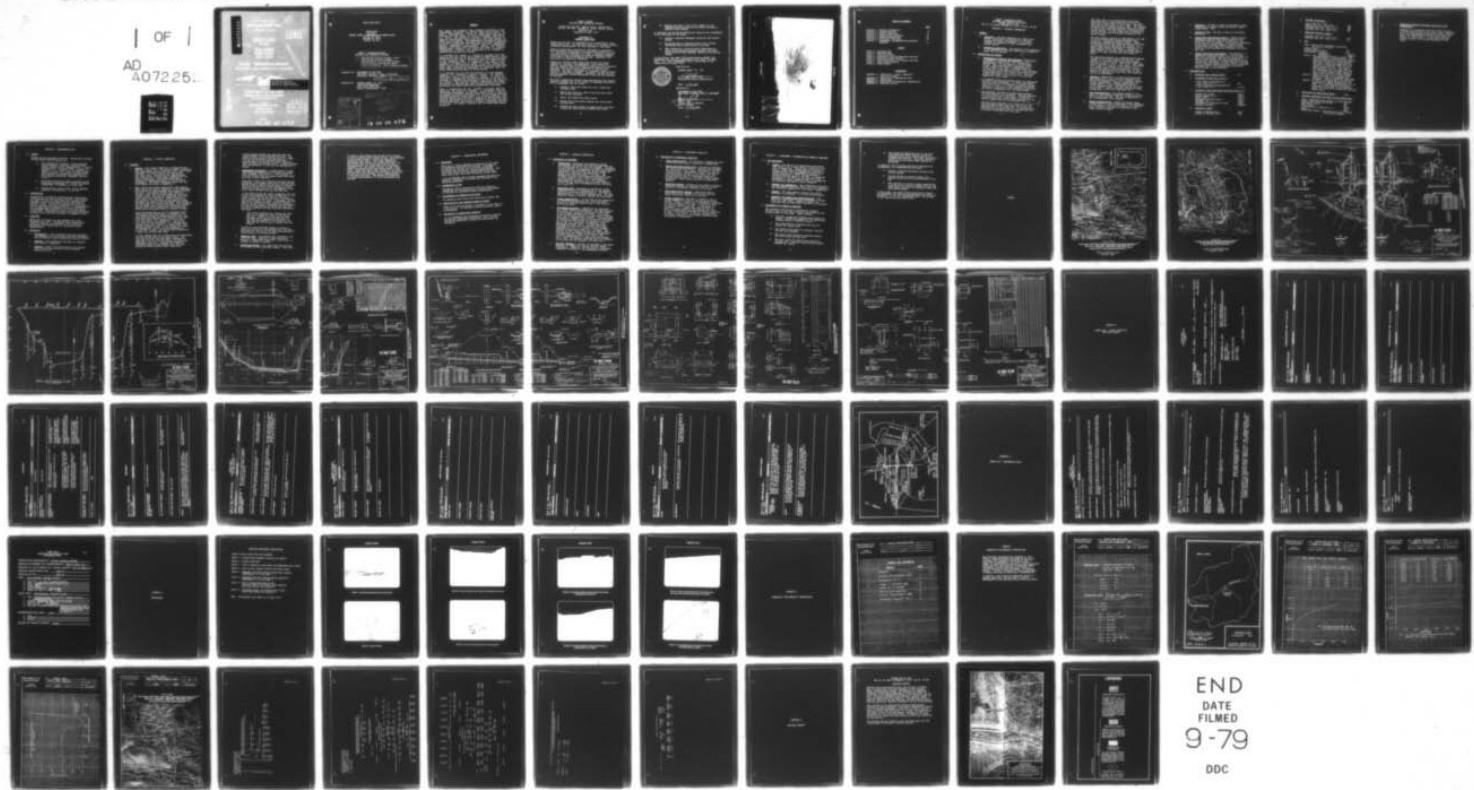
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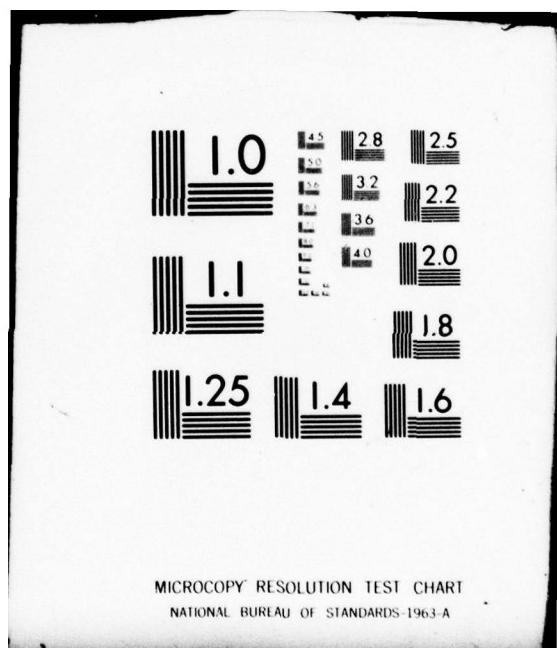
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NATIONAL INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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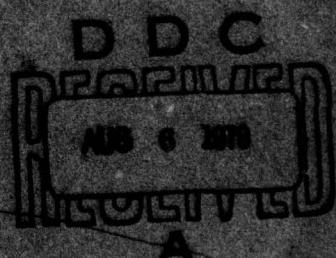
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OHIO RIVER BASIN

HADLEY DAM

(PA 489)

MERCER COUNTY, COMMONWEALTH OF PENNSYLVANIA

NDI No. PA 00245

PennDER No. 43-52

SCS No. PA 489

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

(6) National Dam Inspection Program. Hadley Dam (PA-489, NDI Number PA-00245, PennDER Number 43-52, SCS Number PA-489), Ohio River Basin, Morrison Run, Mercer County, Pennsylvania. Phase I Inspection Report.

Prepared for: DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

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PREFACE

This report was prepared under guidance contained in the "Recommended Guidelines for Safety Inspection of Dams," for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I Inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

Hadley Dam (PA 489), Mercer County, Pennsylvania
NDI No. PA 00245, PennDER No. 43-52, SCS No. PA 489
Morrison Run
Inspected 27 April 1979

ASSESSMENT OF
GENERAL CONDITIONS

Hadley Dam (PA 489) is classified as an "Intermediate" size- "High" hazard dam. The structure consists of a zoned earthfill embankment approximately 750 feet long and 51 feet high.

Hydraulic/hydrologic evaluations, performed in accordance with procedures established by the Baltimore District of the U.S. Army Corps of Engineers for Phase I Inspection Reports, revealed that the spillways will pass the Probable Maximum Flood (PMF) without overtopping the dam. Therefore, the spillways are considered "adequate."

Taking into account those items noted during the visual inspection, available correspondence, prior inspection reports, calculations and information obtained from interviewing local Mercer County Soil Conservation Service (SCS) personnel, the dam is considered to be in good overall condition. The dam is situated in a somewhat remote location and has no operating equipment. Therefore, the dam has only received sporadic visits from Mercer County and SCS personnel in the past.

The visual inspection revealed some deficiencies that require remedial treatment but do not signify an emergency situation. It is recommended that the owner:

- 1) Regrade, treat and reseed the ruts, eroded and sloughed areas.
- 2) Remove the trash and debris from atop and around the intake structure.
- 3) Refill and reseed the rodent holes.
- 4) Replace the joint sealer between the outlet pipe and head wall.
- 5) Regrade the area around the impact basin and place a granular cushion/filter beneath the riprap.

- 6) Regrade the area in the outlet channel of the emergency spillway and provide proper drainage to prevent future piping.

In addition, the following operational measures are recommended to be undertaken by the owner:

- 1) Develop a detailed emergency operation and warning system.
- 2) During periods of unusually heavy rain, provide around-the-clock surveillance of the dam.
- 3) When warning of a storm of major proportions is given by the National Weather Service, the owner should activate the emergency operation and warning system.

In the future, the owner should periodically inspect the embankment and concrete appurtenances and repair as necessary. It is also recommended that a log be kept of the inspections and repair work.

Submitted by:

MICHAEL BAKER, JR., INC.

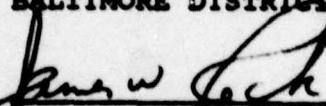


C. Y. Chen, Ph.D., P.E.
Engineering Manager-Geotechnical

Date: 9 July 1979

Approved by:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS



JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Date: 21 Jul 1979

HADLEY DAM



Overall View

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and Field Sketch
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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
HADLEY DAM (PA 489)
NDI No. PA 00245, PennDER No. 43-52, SCS No. PA 489

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

- a. Authority - The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.
- b. Purpose of Inspection - The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 DESCRIPTION OF PROJECT

- a. Description of Dam and Appurtenances - Hadley Dam, a floodwater retarding dam designed by the U.S. Department of Agriculture, Soil Conservation Service (SCS), is also known by its SCS number PA 489. The zoned earthfill embankment has a crest length of 750 feet, a maximum height of 51 feet, and a top width of 18 feet. The upstream side slope is 3H:1V (Horizontal to Vertical) with a 10-foot wide berm at El. 1108.0 feet. The downstream side slope is 2H:1V with a 10-foot wide berm at El. 1117.0 feet.

→ A foundation drain is provided under the downstream portion of the embankment. A 4-foot wide trench was excavated in the foundation to depths varying from 3 to 10 feet. A 12-inch diameter perforated drainpipe is provided in the foundation drain with its outlet discharging into the impact basin.

→ The principal spillway is located approximately 630 feet from the left abutment. The main features of the spillway are a pond drain, a reinforced concrete riser and a pipe conduit through the fill with an impact basin at the discharge end.

The pond drain consists of 52 linear feet of 24-inch corrugated metal pipe that drains into the upstream face of the riser unit. A cover plate is installed on the inside face of the upstream wall to prevent discharges from this pipe.

The riser unit is a concrete drop inlet type structure with a crest elevation of 1108.0 feet and a total crest width of 13.33 feet. The floor elevation of the riser is 1097.0 feet. Two concrete end walls and a concrete splitter beam are located on top of the riser and function as modified anti-vortex devices. A steel trash rack is fastened to the top of the riser to prevent blockage of the outlet conduit.

The pipe conduit consists of approximately 260 feet of 30-inch reinforced concrete pressure pipe placed on a reinforced concrete cradle. Eight reinforced concrete anti-seep collars are provided at intervals of 25 feet along the conduit. An impact basin energy dissipator is provided at the down gradient end of the conduit. Beyond the impact basin is a 20-foot long rock-lined channel which is 12 feet wide and has side slopes of 2H:1V.

The emergency spillway is a vegetated earth channel located in the right abutment of the dam. The channel is a 180-foot wide trapezoidal channel with side slopes of 3H:1V. The 30-foot wide level control section is at El. 1141.0 feet. The channel has a slope of 2 percent at the entrance and a 2.3 percent slope in the exit portion. An earth dike is provided along the inside slope of the channel to keep the flow away from the downstream toe of the embankment.

- b. Location - Hadley Dam is located on Morrison Run approximately 0.6 mile from its confluence with the Little Shenango River, Perry Township, Mercer County, Pennsylvania. Hadley, Pennsylvania is located about 2.0 miles downstream along the Little Shenango River. The dam site can be found on the USGS 7.5 minute quadrangle Greenville East, Pennsylvania, N 41° 25.5' and W 80° 15.1'.
- c. Size Classification - The maximum height of the dam is 51 feet and the reservoir volume to the dam crest is 840 acre-feet. The dam is therefore in the "Intermediate" size category.
- d. Hazard Classification - There are several homes located within 0.5 mile downstream of the embankment. In the event of a dam failure many lives could be lost; therefore, the dam is classified in the "High" hazard category.

- e. Ownership - The dam is owned by the Mercer County Commissioners, Mercer County Courthouse, Mercer, Pennsylvania 16137.
- f. Purpose of Dam - The dam is used for floodwater detention.
- g. Design and Construction History - Hadley Dam was designed by the SCS under the authority of the Watershed Protection and Flood Prevention Act, Public Law 566, as amended. The dam was constructed by the Foster Grading Company, Jackson Center, Pennsylvania from June 1967 through July 1968, with the winter shutdown from December 1967 until May 1968.
- h. Normal Operational Procedures - The reservoir is typically at the riser crest El. 1108.00 feet. There has reportedly been no major flood since the dam was constructed. The dam is inspected on a yearly basis according to procedures for SCS dams. Operational information is very limited as the dam is in a somewhat remote location, has no operating equipment and is only sporadically visited by Mercer County or SCS personnel.

1.3 PERTINENT DATA

a. <u>Drainage Area (square miles)</u> -	4.6
b. <u>Discharge at Dam Site (c.f.s.)</u> -	
Outlet Works at Maximum Pool (El. 1148.7 ft.) -	128
Spillway Capacity at Maximum Pool (El. 1148.7 ft.) -	11,133
c. <u>Elevation (feet above Mean Sea Level [M.S.L.])</u> -	
Design Top of Dam -	1148.7
Maximum Design Pool -	1145.9
Riser Crest -	1108.0
Emergency Spillway Crest -	1141.0
Sediment Pool -	1108.0
Streambed at Centerline of Dam -	1098+
Maximum Tailwater -	Unknown
d. <u>Reservoir (feet)</u> -	
Length of Maximum Pool -	3200
Length of Sediment Pool -	1200

e. Storage (acre-feet) -

Top of Dam (El. 1148.7 ft.) -	820
Maximum Pool (El. 1145.9 ft.) -	695
Spillway Crest (El. 1141.0 ft.) -	568
Sediment Pool (El. 1108.0 ft.) -	25

f. Reservoir Surface (acres) -

Spillway Crest (El. 1141.0 ft.) -	29.5
Sediment Pool (El. 1108.0 ft.) -	4.8

g. Dam -

Type - Zoned earth embankment containing
112,124 c.y. of fill

Length (feet) -	750
Maximum Height (feet) -	51
Side Slopes - Upstream -	2.91H:1V
Downstream -	1.94H:1V

Zoning - The embankment contains 4 zones. The upstream slope is constructed of well to poorly graded gravels with gravel-sand mixtures, little or no fines (GM-GP). The cutoff trench and impervious zone consists of inorganic clays of low to medium plasticity (CL). The center zone consists of silty sands (SM) and the downstream zone is constructed of well to poorly graded sands, gravelly sands with little or no fines (SM-SP).

Cutoff - Compacted earth with a maximum base width of 20 feet in foundation and lower abutments. Constructed of CL material.

Drains - A 4-foot wide trench excavated in the foundation to depths varying from 3 to 10 feet. A 12-inch diameter perforated drainpipe is provided in the foundation drain with its outlet discharging into the impact basin.

h. Diversion and Regulating Tunnel - None

i. Spillway (Emergency Spillway in SCS Terminology) -

Type - Vegetated earth channel in right abutment

Length (feet along centerline) -	800
----------------------------------	-----

Base Width (feet) -	180
---------------------	-----

Side Slopes -	3H:1V
---------------	-------

Crest Elevation (feet M.S.L.) -	1141.0
---------------------------------	--------

Gates -	None
---------	------

Downstream Channel - Spillway exits into 15-foot wide natural channel

i. Regulating Outlets (Principal Spillway in SCS Terminology) -

Consists of a reinforced concrete riser structure, with the overflow weir at El. 1108.0 feet, connected to the 30-inch diameter reinforced concrete outlet pipe. The downstream end of the outlet pipe has invert El. 1092.0 feet. A cover plate has been bolted in place over the pond drainpipe in the riser.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

Hadley Dam was designed by the SCS. Design data included in this report were obtained from:

- 1) SCS Drawings No. PA-489-P, "Little Shenango River Watershed, Floodwater Retarding Dam PA-489, Mercer County, Pennsylvania," 17 Sheets, designed 1966, "as built" 1968. (Copies of Sheets 3, 4, 6, 7 and 12 are included in this report as Plates 3-7; prints of other sheets are available in Pennsylvania Department of Environmental Resources' PennDER1 and SCS's files.)
- 2) Dam Permit Application Report prepared by the Pennsylvania Department of Forests and Waters (predecessor of PennDER) on 10 May 1966.
- 3) "Design Report, Site PA 489, Little Shenango Watershed, Pennsylvania," by the SCS.

2.2 CONSTRUCTION

Chronological information concerning the construction of Hadley Dam was not available; however, some information such as start and stop dates were obtained from PennDER's files and the Mercer County Conservation District office. During the construction of the dam, the SCS provided full-time inspection. A representative of the Pennsylvania Department of Forests and Waters (now PennDER) made periodic visits to the dam during construction. Memoranda and black and white photographs of these visits are also available in PennDER's files.

2.3 OPERATION

Hadley Dam is normally at the sediment pool level throughout the year. The Mercer County Conservation District personnel are responsible for scheduling maintenance and inspections for the Mercer County Commissioners.

2.4 EVALUATION

- a. Availability - The information reviewed consisted of PennDER's file on the dam along with information from the Mercer County Conservation District office.
- b. Adequacy - The information available is adequate for a Phase I Inspection.
- c. Validity - There is no indication at the present time to doubt the validity of the available engineering data.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

- a. General - The visual inspection of Hadley Dam was made on 27 April 1979. No unusual weather conditions were experienced and the lake was at El. 1108.7 feet; therefore, 0.7 feet of water was flowing over the riser crest. The dam and its appurtenances were found to be in good overall condition at the time of inspection. Noteworthy deficiencies observed are described briefly in the following paragraphs. The visual inspection check list and field sketch are given in Appendix A.
- b. Dam - There were several superficial deficiencies noted during the visual inspection of the embankment. The majority of these problems were erosion ditches and ruts. The erosion ditches were formed by surface runoff; the ruts were caused by vehicular traffic on the crest and the downstream face (see field sketch for location). Rodent holes were also found at two locations on the upstream face. Sloughing was noted on the downstream face between the crest and the 10-foot wide bench. This sloughing did not appear to be recent and therefore probably occurred soon after construction and before the ground cover had grown enough to prevent movement.

Along the downstream toe of the embankment there were several wet areas noted. According to the rain gaging station at Pymatuning State Park, the local area had received 1.09+ inches of rain from 8:00 AM 26 April 1979 through 8:00 AM 27 April 1979 (the date of our inspection). Due to the rain prior to the inspection, it is assumed that the wet areas were a result of runoff rather than seepage through the dam. In an attempt to verify the assumption, a site visit was performed on 5 June 1979; however, our efforts were thwarted by a heavy rain on this date also.

A minor seepage area was located below the downstream toe just to the left of the impact basin. The flow from the area was very small (estimated at less than 5 g.p.d.) and no evidence of piping was observed in the area. Although the seepage is considered minor at the present time, the area should be checked during future inspections.

A large piping problem was observed along the outlet channel of the emergency spillway. The materials have piped out at the mouth of a small rill at the end of the emergency spillway. Although this piping does not affect the structural integrity of the dam itself, it does indicate that the materials in the area are susceptible to piping.

- c. Appurtenant Structures - A large amount of trash and debris was found around and atop the intake riser assembly (see Photo 1). The concrete in both the intake riser and impact basin were noted as being in good condition.

Some minor erosion has occurred along the outside perimeter of the impact basin and a sink hole has formed directly behind the head wall of the basin. This hole may be due to fines washing out from behind the outlet pipe due to the absence of the joint sealer between the pipe and head wall.

It was noted during the visual inspection that the outlet pipe extended out from the head wall 2 to 3 inches at the top and was flush at the bottom. After checking the "as built" plans, which showed the pipe and head wall flush, a telephone call was made to Mr. Richard Crowley, District Conservationist, Mercer County, concerning the discrepancy. Mr. Crowley discussed the problem with the construction inspector and the following explanation was given:

"The normal procedure for forming the head wall is to plumb the forms to the top of the pipe. However, on this dam (PA 489), the pipe has an unusually high grade, so the form was plumbed to the bottom of the pipe and the top allowed to extend from the forms."

If this is true (and there seems no reason to doubt the validity of the explanation), the pipe and head wall are now in the same configuration as constructed and no problem exists.

- d. Reservoir Area - No problems were observed in the reservoir area. Reservoir slopes are gently sloping to moderately steep with a good cover of grasses or stands of forests.
- e. Downstream Channel - No significant obstructions are located in the downstream channel. The first

0.5 mile of the stream from the dam flows through a heavily wooded narrow stream valley. The remainder of the stream valley is wider and consists of relatively open areas. The slopes immediately downstream from the dam are relatively steep. As the stream nears its confluence with the Little Shenango River, the slopes flatten out and remain moderately sloping along the entire length of the river. There are three homes located in low lying areas between the dam and the confluence of Morrison Run and the Little Shenango River (approximately 1 mile below the dam). The Borough of Greenville is located approximately 10 miles downstream from the dam.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

There are no formal emergency procedures in the event of impending catastrophe for the dam. According to provisions by the SCS, the dam should be checked following each occurrence of heavy precipitation. The pond drain outlet pipe has been sealed by bolting a cover plate over its outlet within the intake riser.

It is recommended that a formal emergency procedure be prepared, prominently displayed and furnished to all operating personnel.

4.2 MAINTENANCE OF DAM

The Mercer County Conservation District office is responsible for the scheduling of routine maintenance of the dam for the Mercer County Commissioners.

4.3 MAINTENANCE OF OPERATING FACILITIES

No operating facilities were installed at Hadley Dam.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

There is no warning system or procedure in the event of a dam failure. An emergency warning procedure should be developed.

4.5 EVALUATION OF OPERATIONAL ADEQUACY

It is recommended that personnel periodically examine the dam and appurtenant structures, and a routine preventive maintenance schedule be established and documented.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

- a. Design Data - Hydrologic and Hydraulic design calculations for Hadley Dam were obtained from the SCS "Design Report" on file with PennDER. According to SCS criteria, the emergency spillway and freeboard hydrographs were developed and routed through the reservoir to establish the elevations of the design high water and crest of the dam. The emergency spillway hydrograph was developed using a 6-hour rainfall of 9.3 inches resulting in a peak discharge of 5948 c.f.s. The freeboard hydrograph was developed using a 6-hour rainfall of 18.7 inches with a corresponding peak discharge of 11,443 c.f.s.
- b. Experience Data - According to the Mercer County Conservation District Representative, the maximum reservoir stage was approximately El. 1126 feet or approximately 18 feet above sediment pool. No other reservoir stage or rainfall records are maintained.
- c. Visual Observations - At the time of the inspection, no condition was observed that could seriously affect the discharge capabilities of the spillway and outlet works.
- d. Overtopping Potential - Hadley Dam is classified as a "High" hazard-"Intermediate" size dam requiring evaluation for a spillway design flood (SDF) equal to the Probable Maximum Flood (PMF). The outlet works and spillway consist of a typical SCS concrete riser and a vegetated earth channel. The hydrologic and hydraulic capabilities of the dam were evaluated by routing the PMF through the reservoir with the aid of the U.S. Army Corps of Engineers' Flood Hydrograph Package, HEC-1. The PMF hydrograph developed as a part of this analysis had a peak discharge of 5777 c.f.s. using a 6-hour Probable Maximum Precipitation (PMP) of 21.9 inches. The results of this routing indicate that the reservoir and spillways are capable of passing the PMF with a maximum reservoir level of El. 1146.1 feet, which is approximately 2.6 feet below the minimum top of dam. The maximum discharge from the reservoir, as indicated by this analysis, is 5760 c.f.s.
- e. Spillway Adequacy - The dam, as outlined in the above analysis, is capable of passing the PMF without overtopping. Therefore, the spillway is considered "adequate" according to the recommended criteria.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

- a. Visual Observations - No structural inadequacies were noted during the visual inspection of Hadley Dam.
- b. Design and Construction Data - The dam was designed and constructed according to standard SCS procedures for structures of this type. According to the SCS "Design Report," the upstream slope of the dam has a minimum safety factor of 1.32 under full draw-down conditions and the downstream slope has a minimum safety factor of 1.52 under steady seepage conditions. These safety factors are considered adequate.
- c. Operating Records - Nothing in the readily available operating information indicates cause for concern relative to structural stability of the dam.
- d. Post-Construction Changes - There have been no post-construction changes which would adversely affect structural stability of the dam.
- e. Seismic Stability - The dam is located in Zone 1 on the "Seismic Zone Map of the Contiguous United States," Figure 1, page D-30, "Recommended Guidelines for Safety Inspection of Dams." This is an area of very low seismic activity. As indicated in paragraph 6.1.b., Hadley Dam could be shown to meet the static stability requirements set forth by the "Recommended Guidelines for Safety Inspection of Dams." As a result, no further consideration of seismic stability is considered necessary under the present circumstances.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

- a. Safety - The dam and its appurtenant structures were found to be in good overall condition at the time of inspection. Hadley Dam is evaluated as being a "High" hazard-"Intermediate" size dam in accordance with the "Recommended Guidelines for Safety Inspection of Dams" and should have a spillway capacity equal to the PMF. As presented in Section 5, the spillway and reservoir were determined to have a capacity equal to the PMF and are therefore assessed as being "adequate."
- b. Adequacy of Information - The information available and the observations made during the field inspection are considered adequate for this Phase I Inspection.
- c. Urgency - The owner should initiate the action discussed in paragraph 7.2 as soon as practicable.
- d. Necessity for Additional Data/Evaluation - The hydraulic/ hydrologic analysis performed in connection with this Phase I Inspection Report has indicated that no additional evaluation is necessary.

7.2 RECOMMENDATIONS/REMEDIAL MEASURES

The inspection and review of information revealed certain items of work which should be performed as soon as practicable by the owner. These include:

- 1) The ruts, eroded and sloughed areas should be graded, treated and seeded with an appropriate seeding mixture to prevent erosion.
- 2) The trash should be removed from atop and around the intake riser.
- 3) The rodent holes should be properly refilled and the area reseeded.
- 4) The joint sealer should be replaced between the outlet pipe and head wall.
- 5) The area around the impact basin should be regraded and a granular cushion/filter placed beneath the riprap.

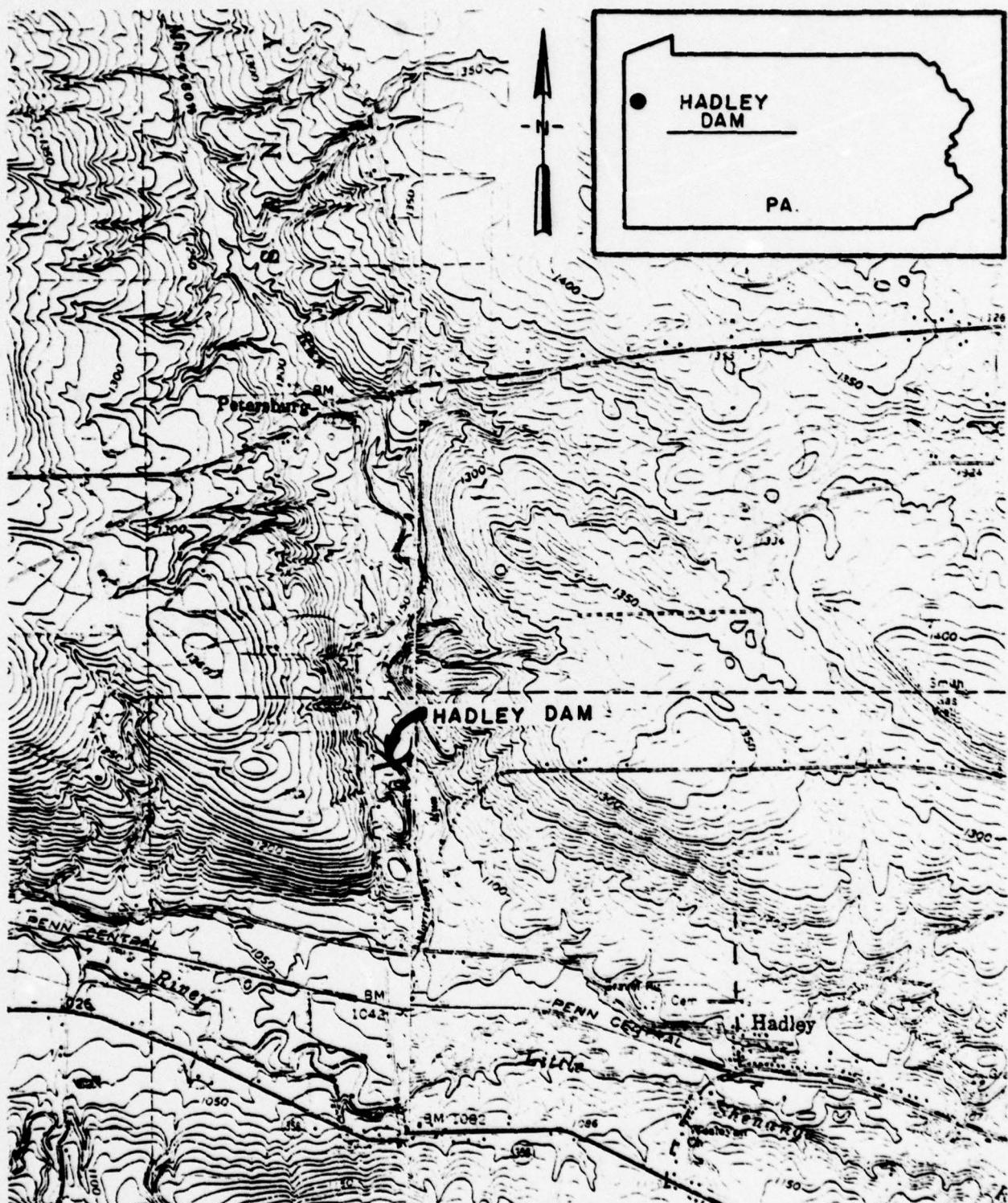
- 6) The marshy and depressed area in the emergency spillway outlet channel should be regraded and provided with proper drainage to prevent future piping. This area should be monitored in the future after repairs are performed.

In addition, the following operational measures are recommended to be undertaken by the owner:

- 1) Develop a detailed emergency operation and warning system.
- 2) During periods of unusually heavy rain, provide around-the-clock surveillance of the dam.
- 3) When warning of a storm of major proportions is given by the National Weather Service, the owner should activate the emergency operation and warning system.

In the future, the owner should periodically inspect the embankment and concrete appurtenances and repair as necessary. It is also recommended that a log be kept of the inspections and repair work.

PLATES



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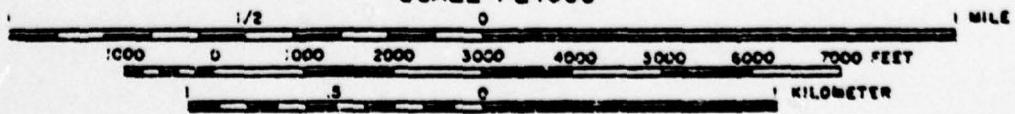
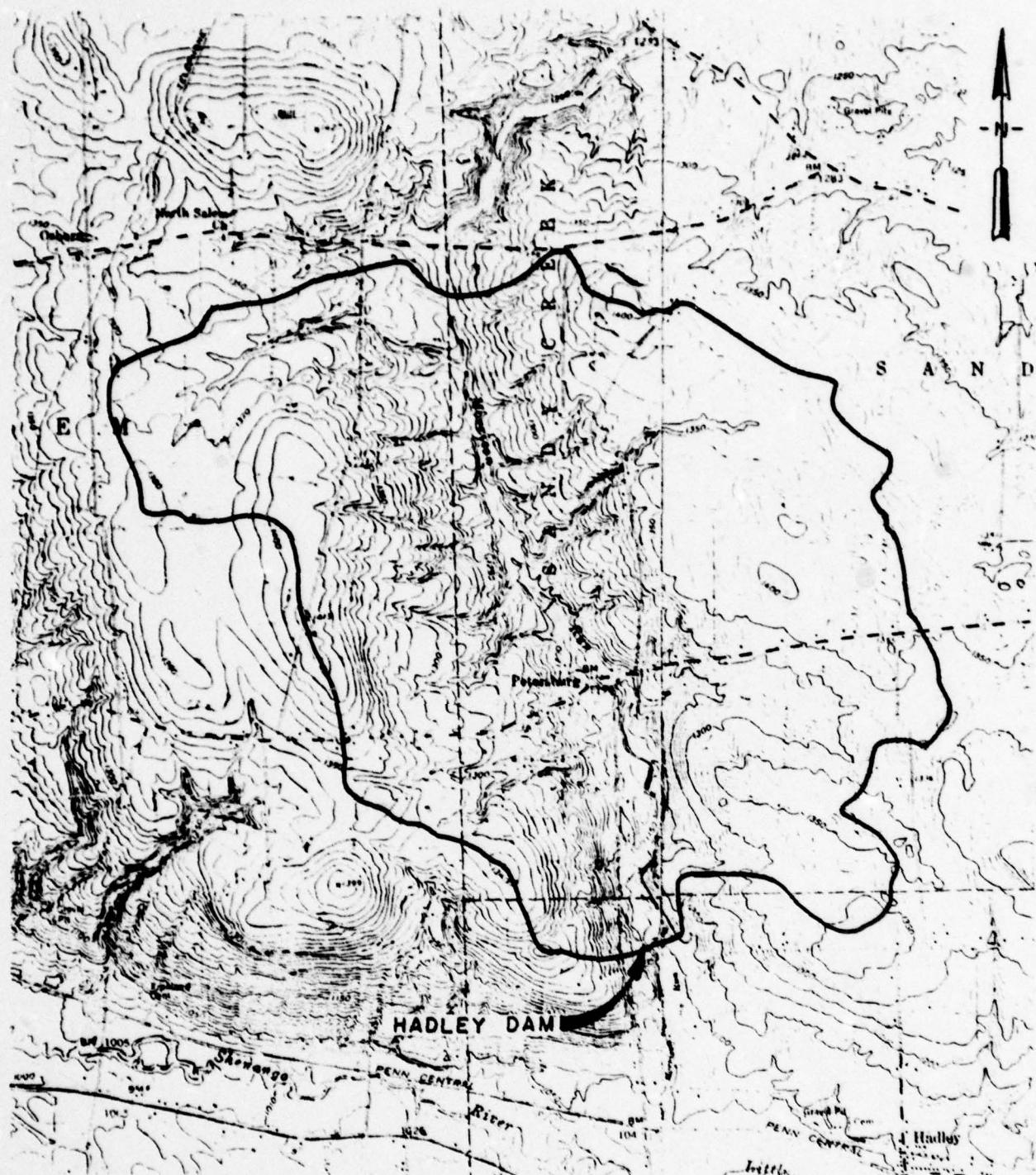


PLATE I LOCATION PLAN
HADLEY DAM



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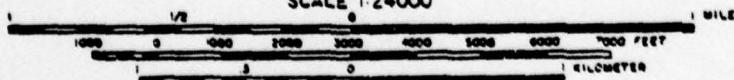
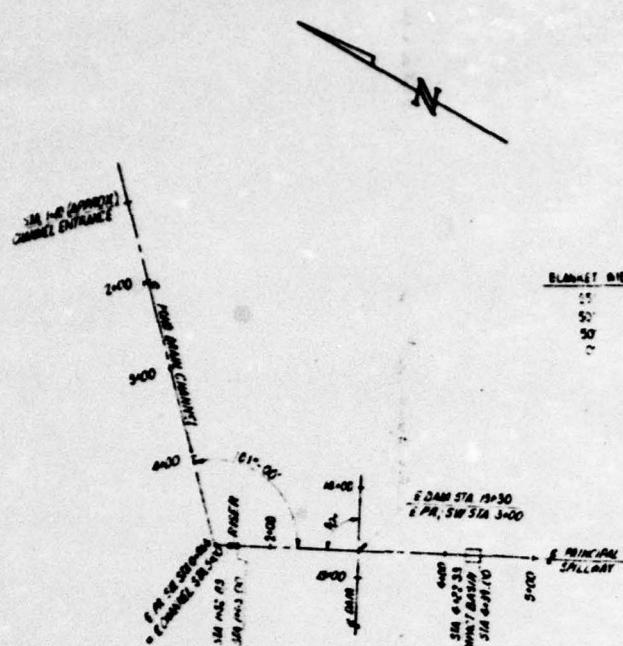
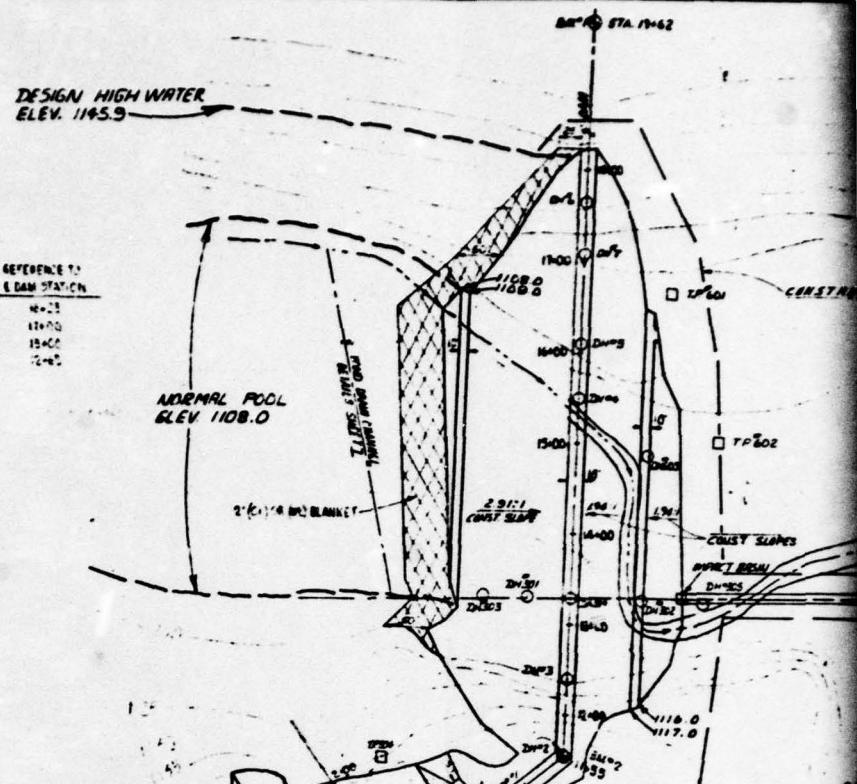


PLATE 2 WATERSHED MAP
HADLEY DAM



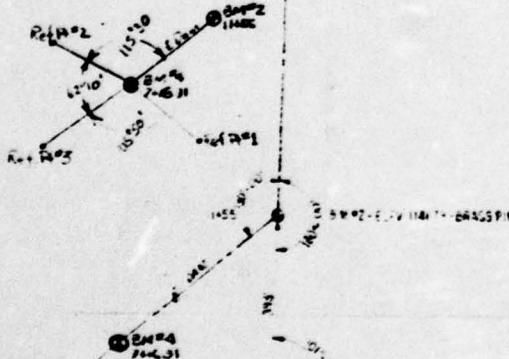
LAYOUT-E OF PRINCIPAL SPILLWAY



DESIGN HIGH WATER
ELEV. 1145.9

REF ID: A61142 BLACK CAM
WASH ALONG LINE FENCE
REF ID: A61143 BLACK CAM
SOUTH ALONG LINE FENCE
14-62 BM #1-ELEV 12190-BRASS PIN
REF ID: A61144 BLACK CAM
ALONG TAN IN 4 ELEV 12190

BM#4 - Brass P... - W of Rd.T-666
Ref Pt #1 - P... - Rule "24 - 33.2"
" " #2 - " " " 22 - 101.7"
" " #3 - 12' DEM wh. Oak - 52" x "



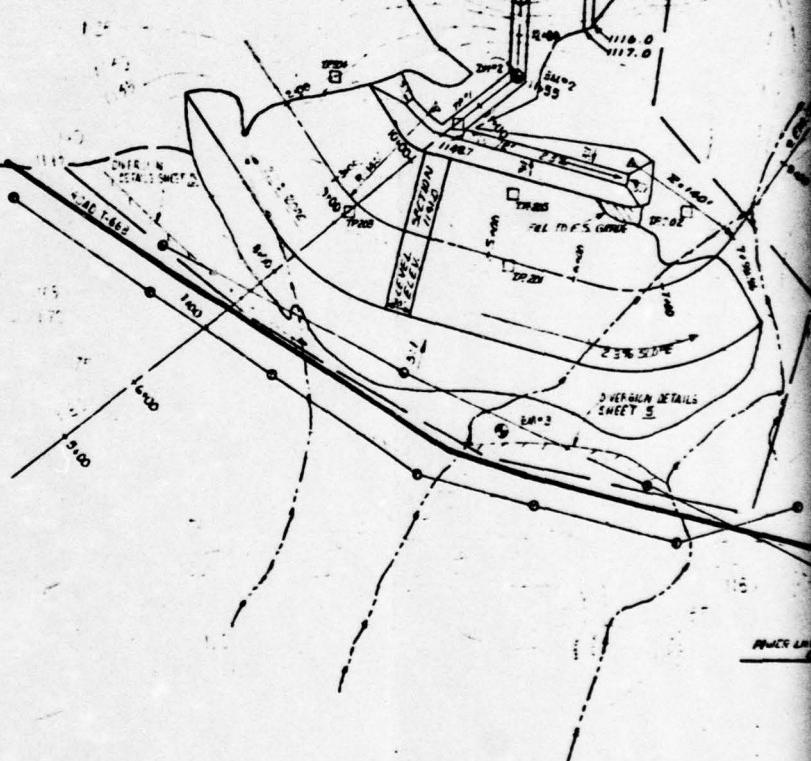
REF PT #2-43 F WINGED BULL IN STATE
ON SOUTH SIDE OF ST. ANTE CREEK
CLUMP OF SWEET GUMS

REF. PER 3-14 CENTER OF SECURITY
SECURITY BOARD OF THE ARMY

CLASS: REGD - C. PLAT E90

REF ID: A-42519-V-200

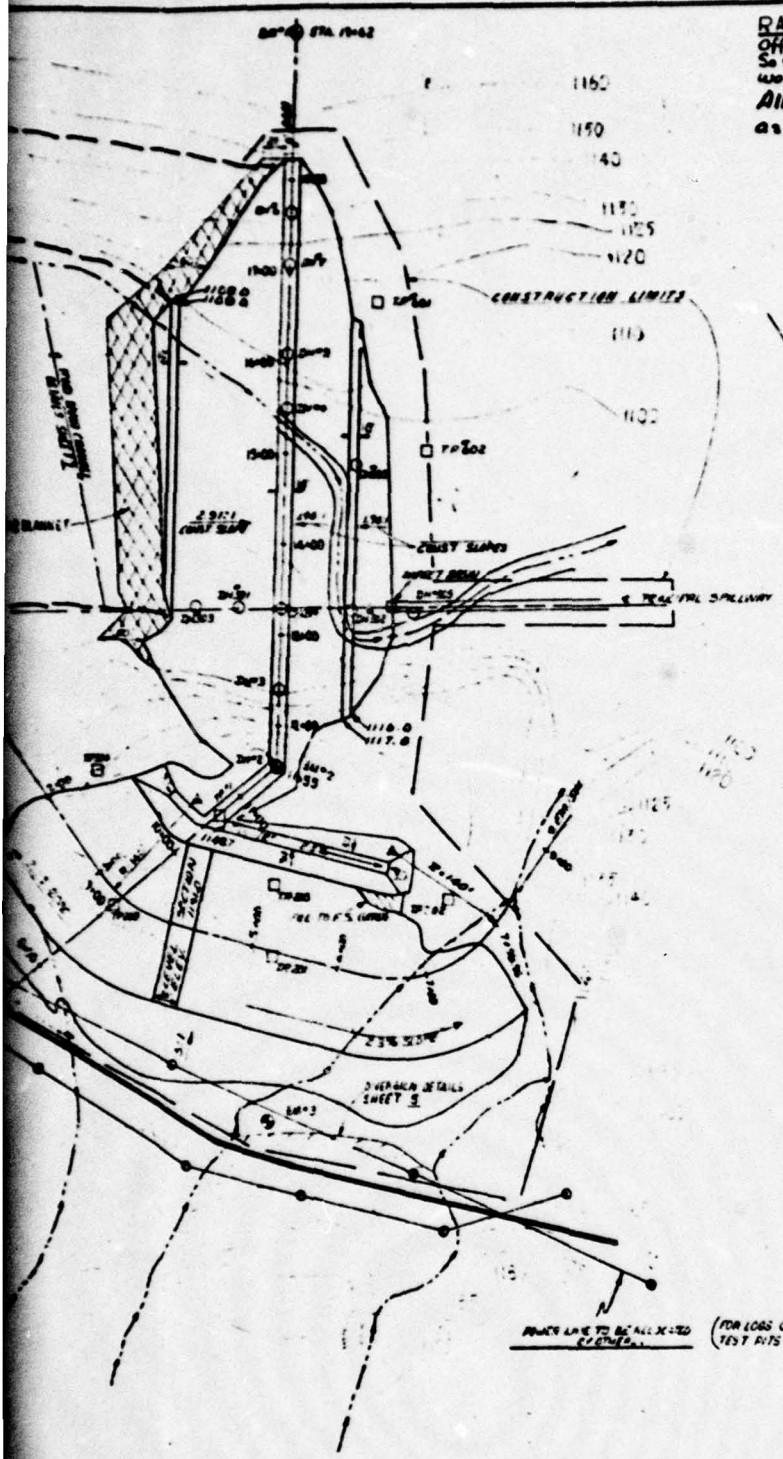
AYOUT OF E LAW AND REFERENCE POINTS
FOR BEACH MARKS



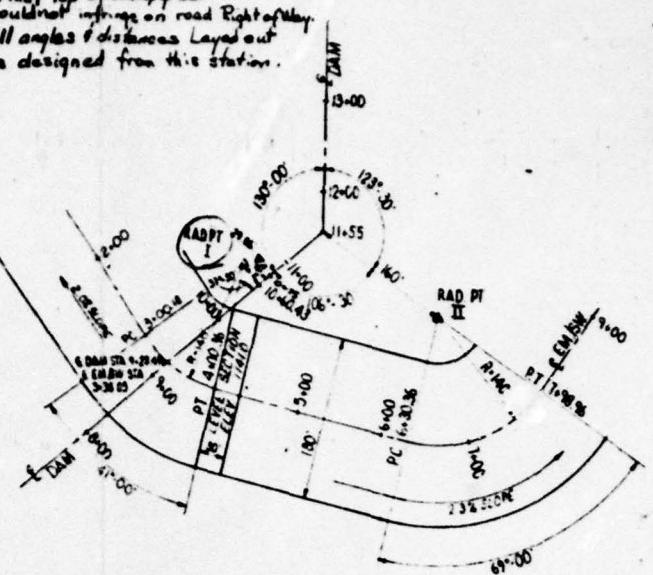
A scale bar diagram with the word "SCALE" at the top. Below it is a horizontal line with tick marks. The first tick mark is labeled "0". The second tick mark is labeled "100". The third tick mark is labeled "200 Feet".

LEED

TYPICAL



RAD Pt I-
Offset from E 5th 100' 75
So that top of Em. Spy cut
wouldn't infringe on road Right of Way.
All angles & distances Layed out
as designed from this station.



AYOUT OF EMERGENCY SPILLWAY E

EMERGENCY SPILLWAY CURVE DATA

Curve I (Entrance)	Curve II (Exit)
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11
12	12
13	13
14	14
15	15
16	16
17	17
18	18
19	19
20	20
21	21
22	22
23	23
24	24
25	25
26	26
27	27
28	28
29	29
30	30
31	31
32	32
33	33
34	34
35	35
36	36
37	37
38	38
39	39
40	40
41	41
42	42
43	43
44	44
45	45
46	46
47	47
48	48
49	49
50	50
51	51
52	52
53	53
54	54
55	55
56	56
57	57
58	58
59	59
60	60
61	61
62	62
63	63
64	64
65	65
66	66
67	67
68	68
69	69
70	70
71	71
72	72
73	73
74	74
75	75
76	76
77	77
78	78
79	79
80	80
81	81
82	82
83	83
84	84
85	85
86	86
87	87
88	88
89	89
90	90
91	91
92	92
93	93
94	94
95	95
96	96
97	97
98	98
99	99
100	100

STATION	DEFLECTION	CWORD
PC 3+LC 1E	0°-00	
3+2012	4°-06	20 02
3+0023	8°-12	20 02
3-6024	12°-18	20 02
3+0033	16°-26	20 02
FT 4+0036	20°-30	20 02

STATION	DEFLECTION S.	CHORD
PC 6-30 36	0°-00'	
+6-72 22	5°-21'	16.85'
6-66 08	6°-54'	16.85'
6-60 94	10°-21'	16.85'
6-57 00	13°-48'	16.85'
+6-46 56	17°-15'	16.85'
+5-31 52	20°-42'	16.85'
+4-48 38	24°-09'	16.85'
+3-65 24	27°-36'	16.85'
+2-82 10	31°-03'	16.85'
PT 6-08 96	34°-30'	16.85'

I = 41°-00'
 R = 140
 T = 92.34°
 L_c = 100.18°
 C₀₂ = 38.06°
 M = 8.67°
 E = 9.47°
 PC = 34.0.18
 AT = 4.60.30

I = 69°-00'
 E = 140°
 T = 96.22°
 L = 168.60°
 C = 158.99°
 M = 24.62°
 E = 29.83°
 R = 6.30.36°
 RT = 36.28.36°

AS BUILT PLANS

PLATE 3



TYPICAL SECTION OF EMERGENCY CALLWAY
AND DIKE
LOOKING DOWNSTREAM

LITTLE SHENANGO RIVER WATERSHED
FLOODWATER RETARDING DAM PA-489
MERCER COUNTY, PENNSYLVANIA
PLAN OF DAMSITE

**U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE**

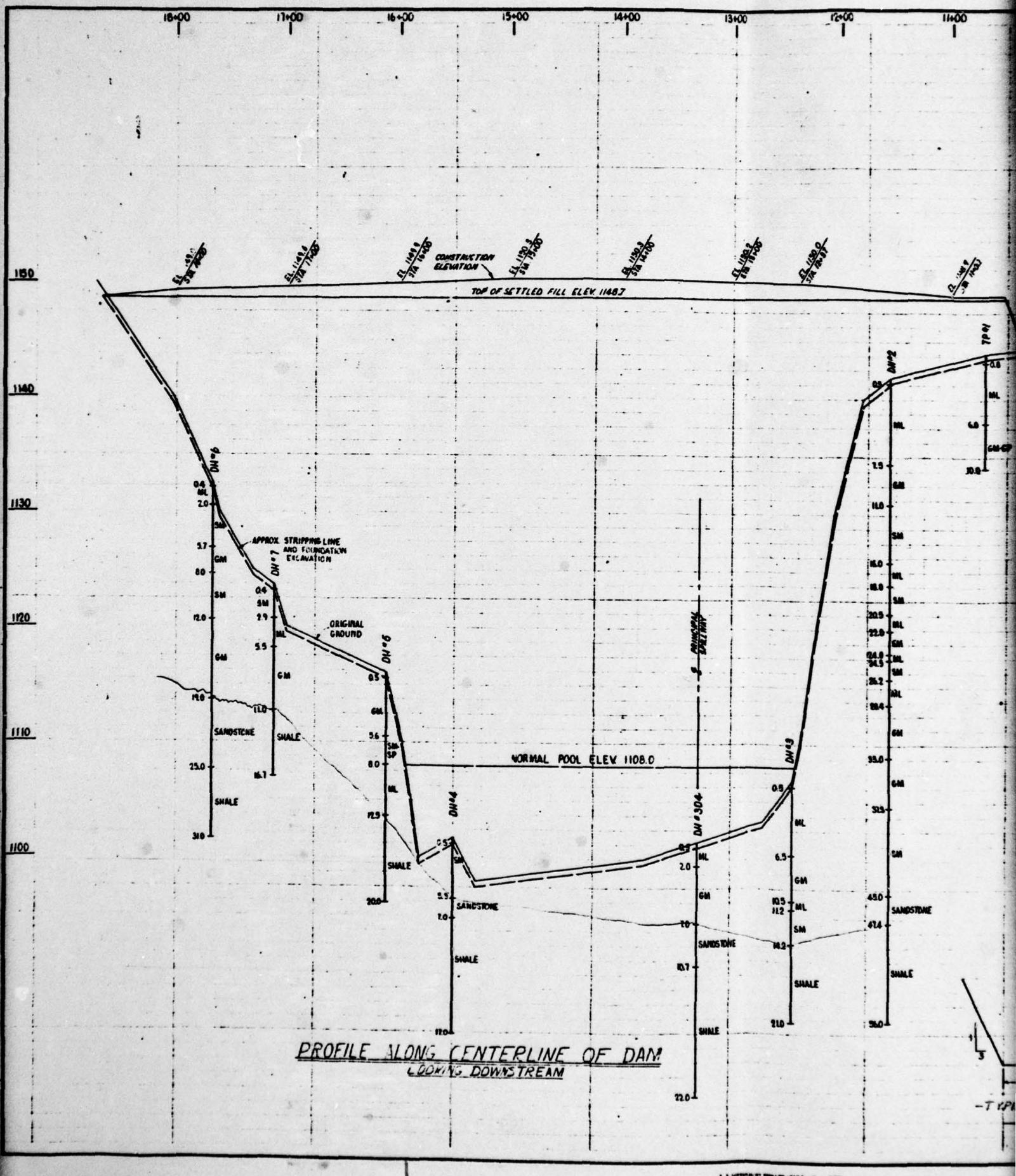
Alfred A. Snyder 2-66

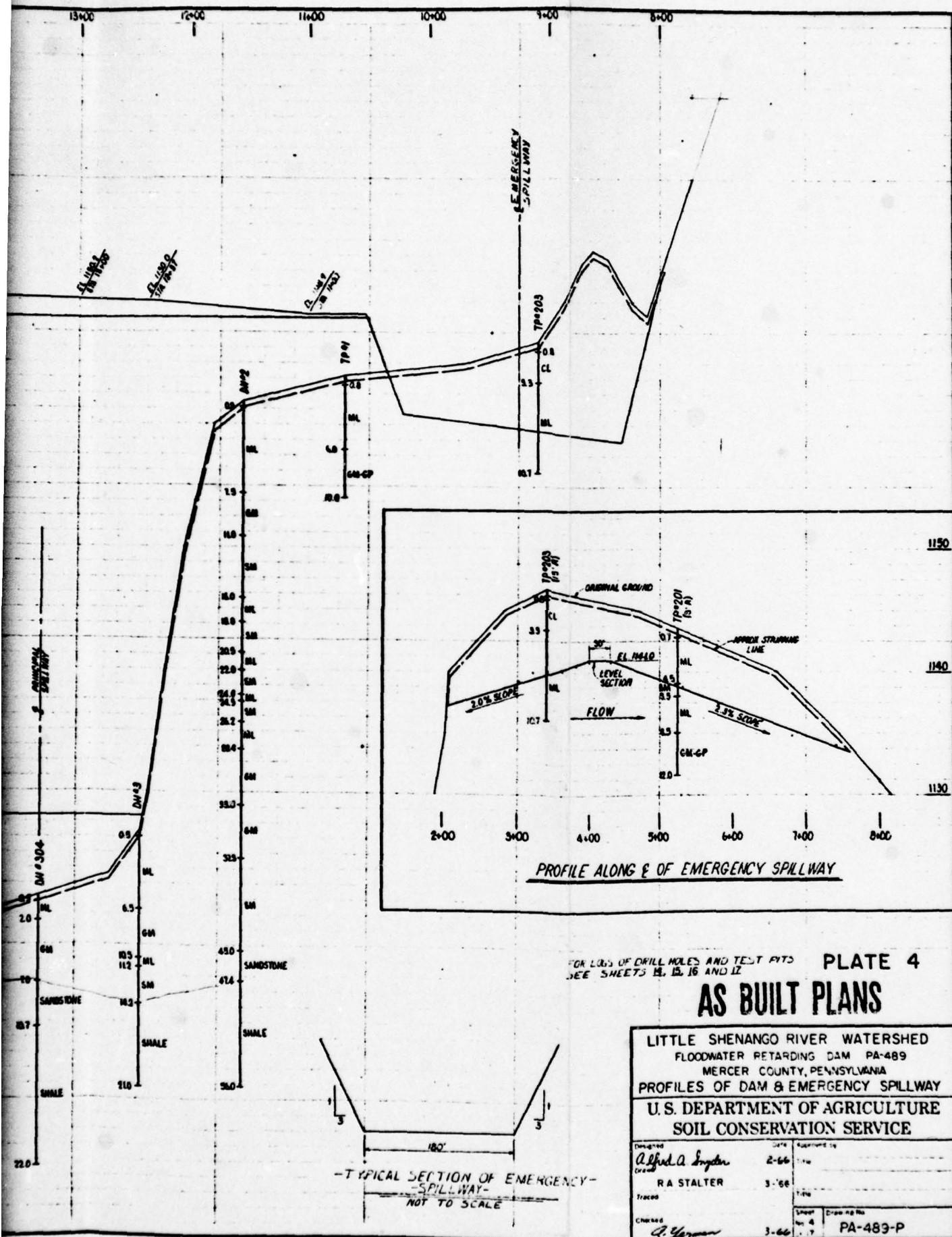
Alfred A. Snyder 2-66

R. A. STALTER 3-66

卷之三

PA 489 R





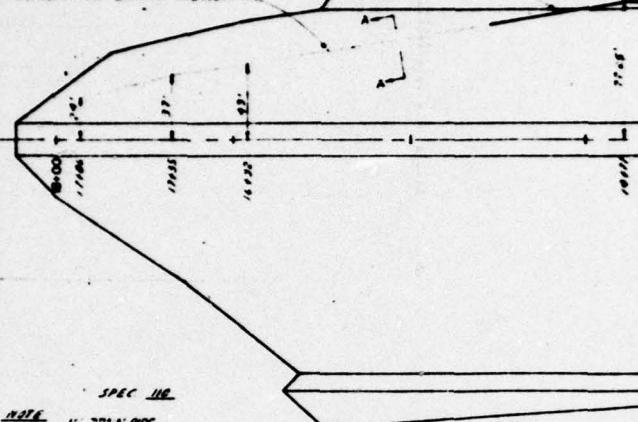
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FROM COPY PUBLISHED TO DDC

12-24 DRAIN PIPE (CORRODED)
 QUANTITY 176 FT/100 FT/100
 12' SECTION
 10' SECTION
 8' SECTION
 11'-8-1/2" ELBOW - 90°
 8'-8" ELBOW - 90°
 8'-0" ELBOW - 90°
 METAL END CAP
 SMALL ANIMAL GUARD

308'-6" TOTAL 152'-6"

USE STANDARD COUPLING BANDS

EXCAVATION DRAIN TRENCH



SPEC 100
 NOTE: ALL DRAINS PIPE
 CLASS 1-SHAPE 1,
 TYPE D, 16-GAGE

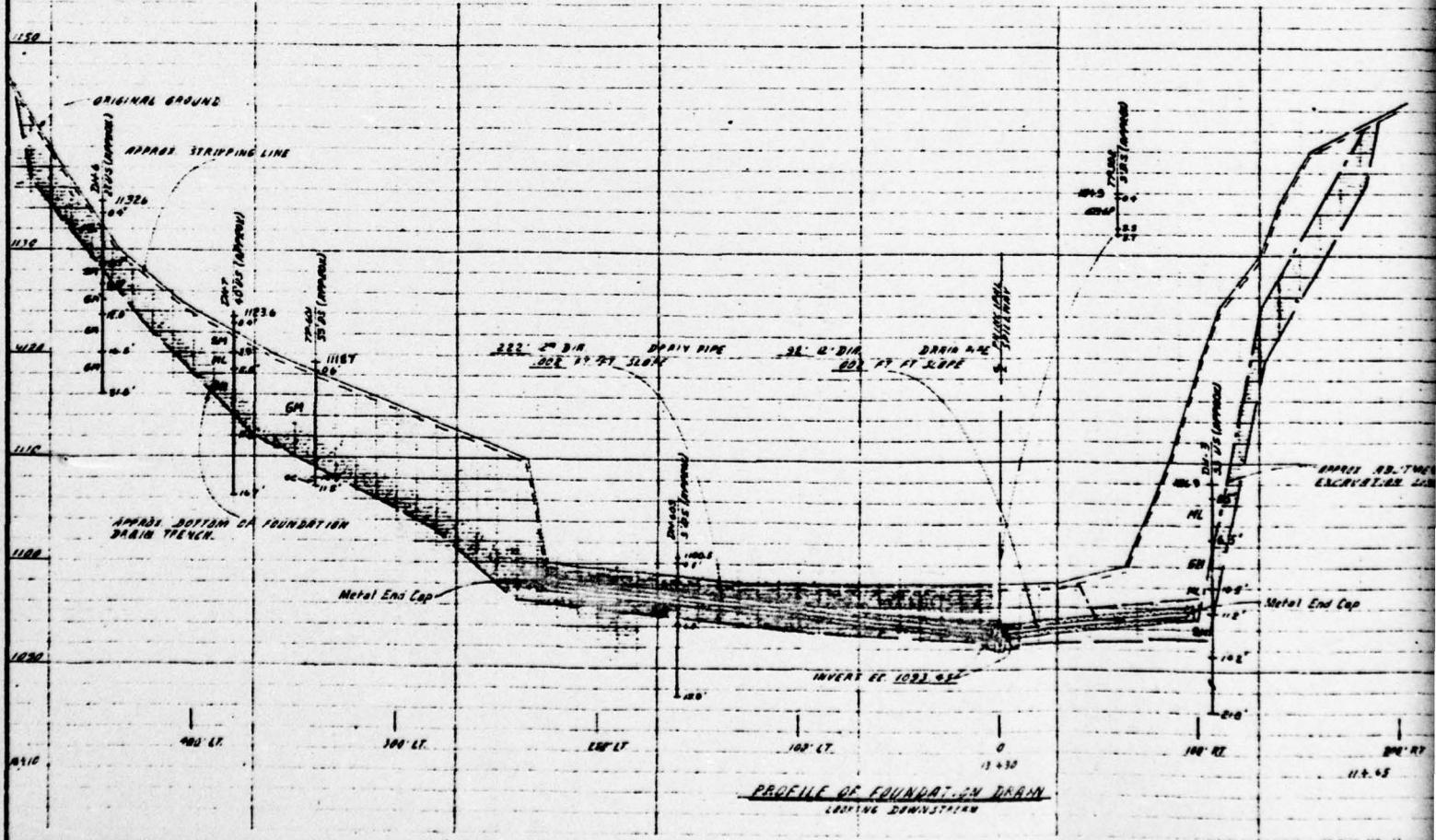
PLAN VIEW OF FOUNDATION DRAIN

0 10 20 30 40
 SCALE IN FEET

TOP OF ROCK

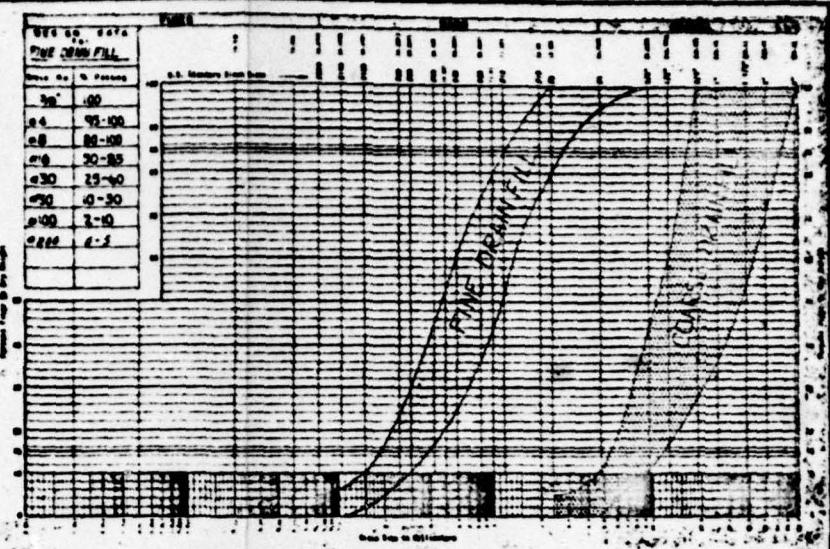
SECTION C-C

Design Dia.	Config. Dia.
5"	5"
6"	6"
10"	10"
12"	12"
16"	16"
18"	18"
20"	20"
24"	24"
26"	26"
30"	30"

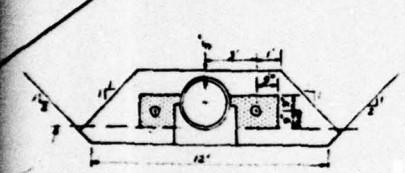


PROFILE OF FOUNDATION DRAIN
 LENGTH 100 FT

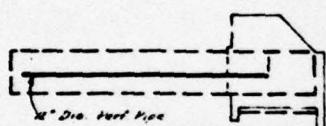
Topical



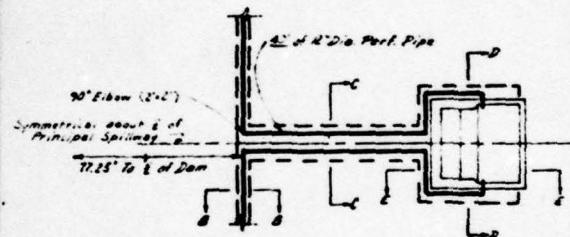
Gradation Limits for Drain Fill



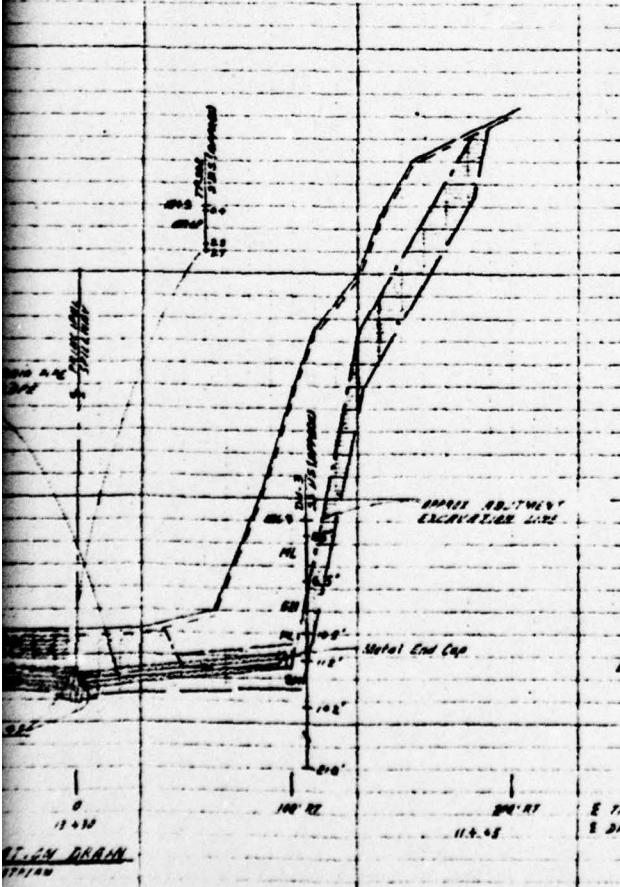
SECTION 5-5



Typical Section Along Foundation from Dugout.



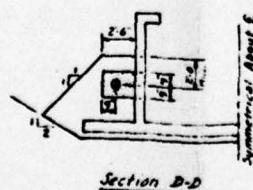
Plan View of Foundation in Rain Survey



For Drain Pipe sizes & details
See Sheet 12

DEPTH OF DRILL HOLES AND TEST PITS -
NOT TO SCALE

AS BUILT PLANS



Section D-D

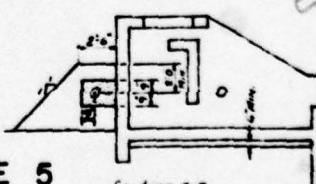
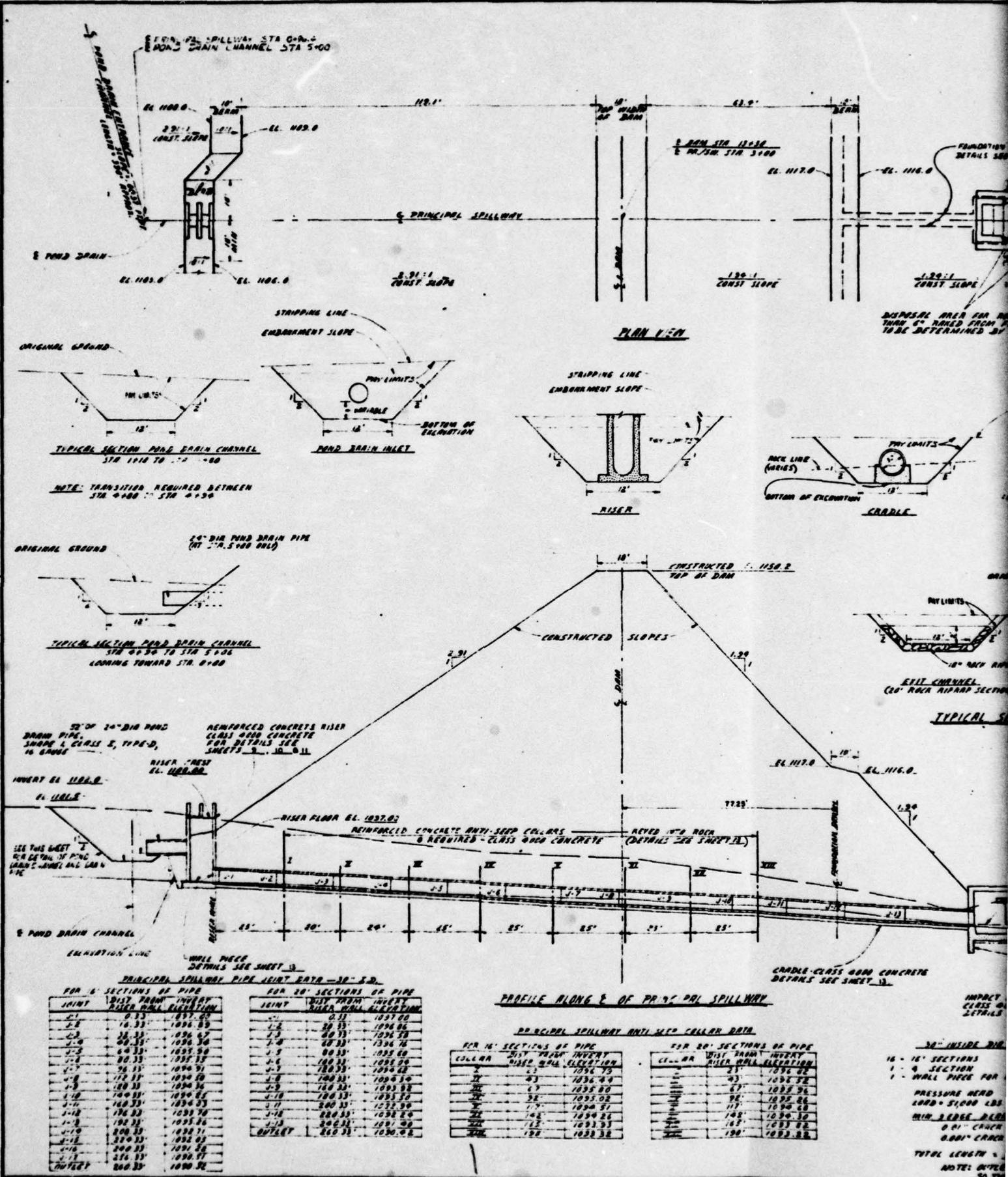
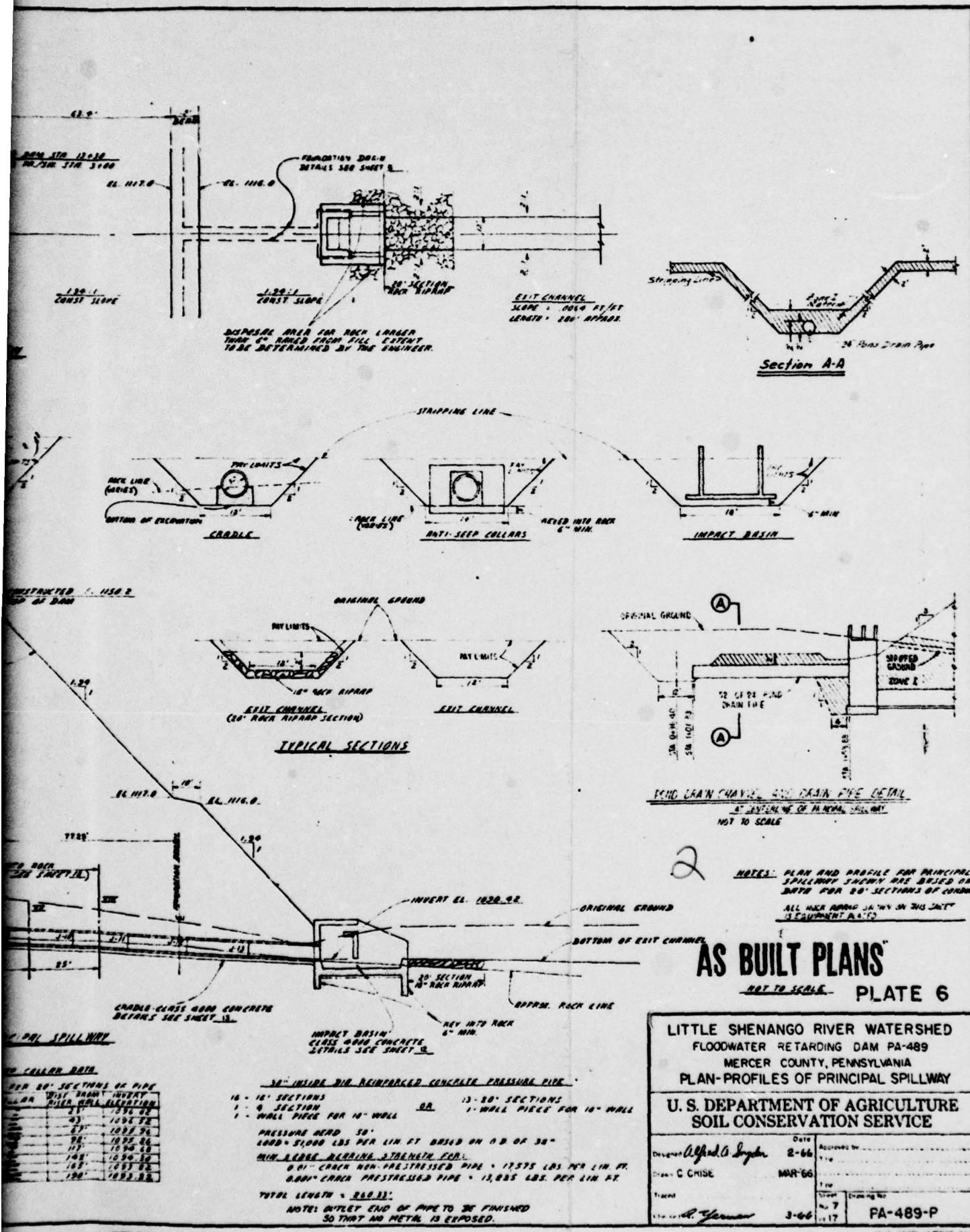


PLATE 5

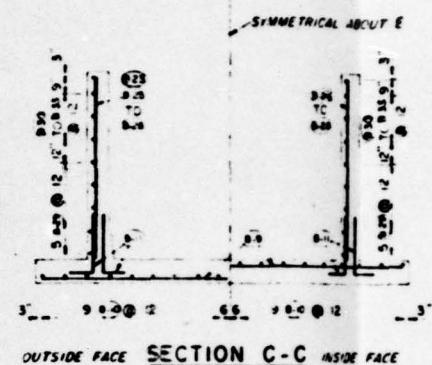
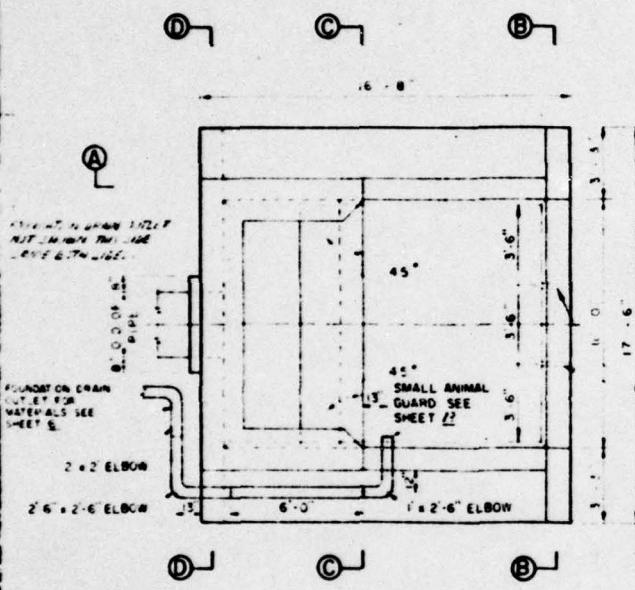
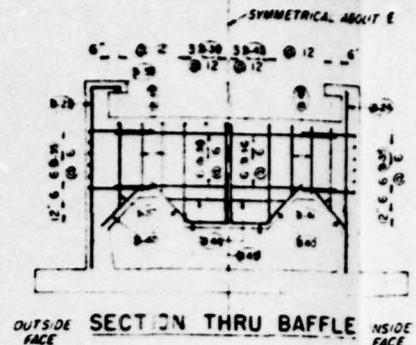
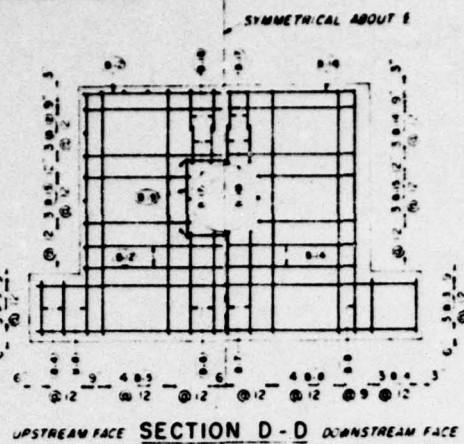
Section E-E

LITTLE SHENANGO RIVER WATERSHED	
FLOODWATER RETARDING DAM PA-489	
MERCER COUNTY, PENNSYLVANIA	
FOUNDATION DRAIN DETAILS	
U.S. DEPARTMENT OF AGRICULTURE	
SOIL CONSERVATION SERVICE	
Designed by	Approved by
<i>R. Johnson</i>	2-66
CRUISE	3-66
R. MAYS	3-66
Reviewed	1-66
Drawn by	Drawing No.
<i>R. Johnson</i>	No. 6
	PA-489-P

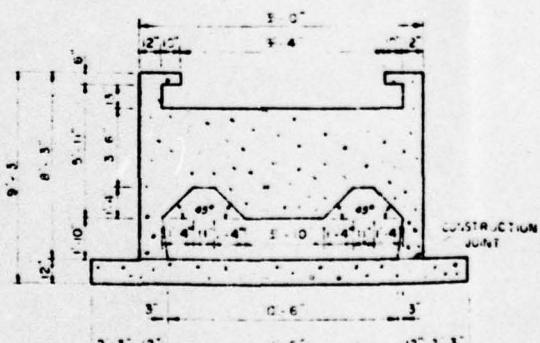
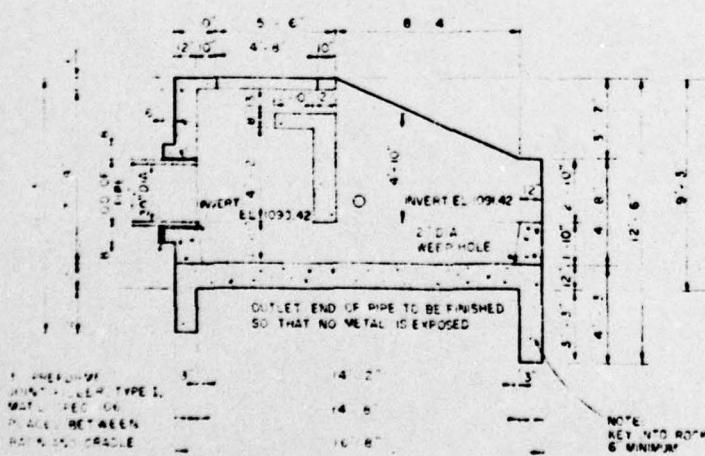
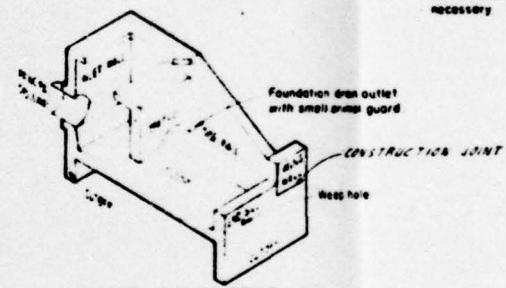




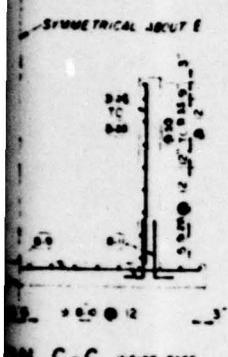
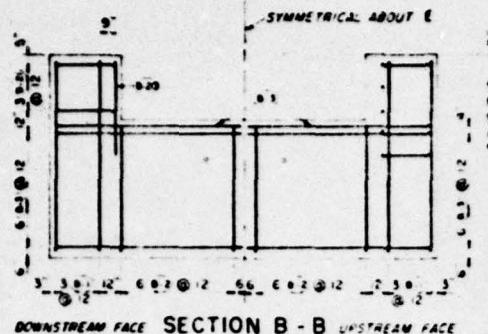
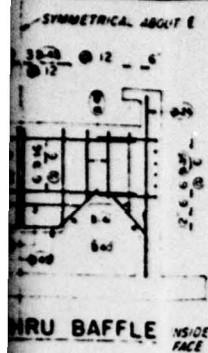
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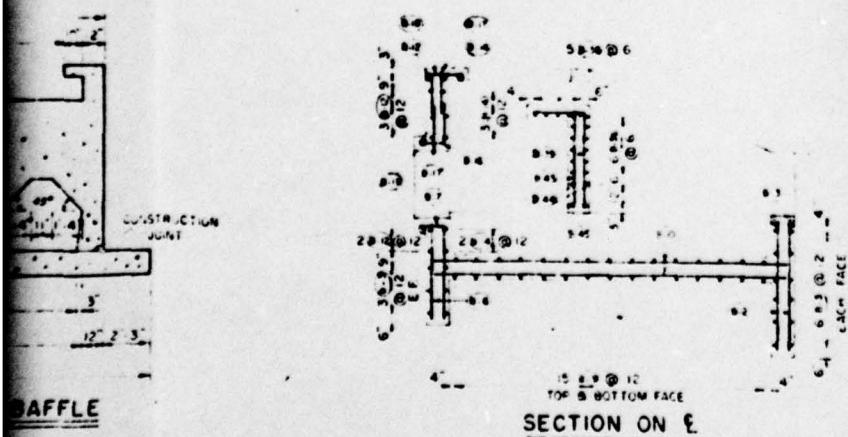
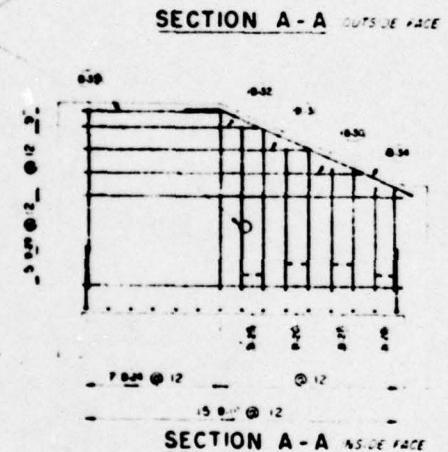
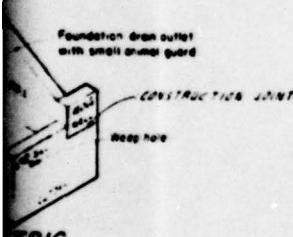
DRAIN PIPE
Bend reinforcing steel
for installation as
necessary



GENERAL NOTES
SEE SHEET 13



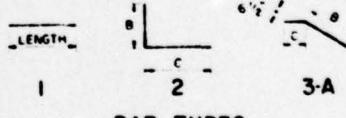
DRAIN PIPE
Jerd reinforcing steel
for installation as
necessary



GENERAL NOTES
SEE SHEET 13

AS BUILT PLANS

STEEL SCHEDULE						
MARK	LOCATION	QAN	SIZE	LENGTH	TYPE	B
						C
B-1	CUTOFF	12	5	8-6		
2		24	5	5-7		
3		20	5	17-0		
4		10	5	2-6		
5		8	5	12-3	2	10-9
6		4	5	4-3		
7		3	5	5-3	2	4-3
8		12	5	10-9		
9	FLOOR	30	5	17-0		
10		36	5	16-0		
11		60	5	3-9	2	2-9
12	INLET WALL	12	5	9-5	2	7-1
13		6	5	6-2	2	4-6
14		7	5	11-6		
15		6	5	5-3	2	4-3
16		3	5	2-9	2	1-9
17		7	5	2-11		
18		4	5	3-0	2	1-3
19		4	5	3-9		1-9
20	WING WALLS	2	5	4-3		
21		6	5	2-9		
22		10	5	4-0	2	2-3
23	SIDEWALLS	14	5	9-6	2	6-0
24		14	5	8-0		
25		8	5	7-1		
26		8	5	6-3		
27		8	5	5-6		
28		8	5	4-6		
29		20	5	16-0		
30		4	5	12-6		
31		4	5	10-3		
32		4	5	7-9		
33		4	5	6-0		
34		4	5	11-1	3A	9-6
35	15 BAFFLE	34	5	3-9	2	2-9
36		17	5	10-6		
37		2	5	6-4	2	4-0
38		4	5	5-4	2	3-0
39		5	5	6-7	2	4-3
40		8	5	2-0		
41		2	5	4-0		
42		4	5	3-0		
43		5	5	4-3		
44		2	5	5-6		
45		2	5	5-6		



QUANTITIES

REINFORCING STEEL
NO. 5 BARS 3946.60 LINE FT 41194 LBS

CONCRETE
CLASS 4000 309 CU YDS

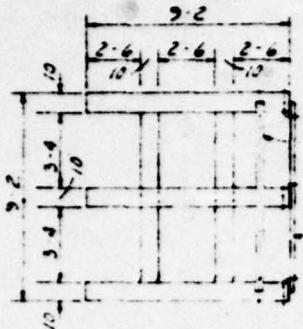
PLATE 7

LITTLE SHENANGO RIVER WATERSHED
FLOODWATER RETARDING DAM PA-489
MERCER COUNTY, PENNSYLVANIA
IMPACT BASIN DETAILS

2
DRAFTED BY
V. V. VACIĆ
HIT GROUPING H

PA-489-P

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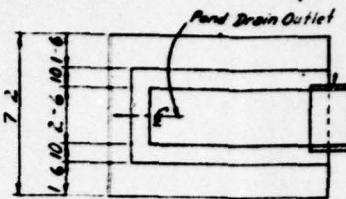
—Each Top Angle Iron Requires
2 "L" Bolts.

—Each Side and Bottom Angle
Iron Requires 3 "L" Bolts.

PLAN - TOP

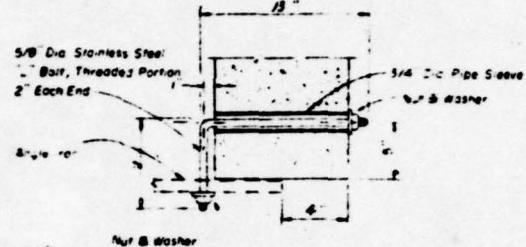


Galv. Steel Angle Iron
is Required

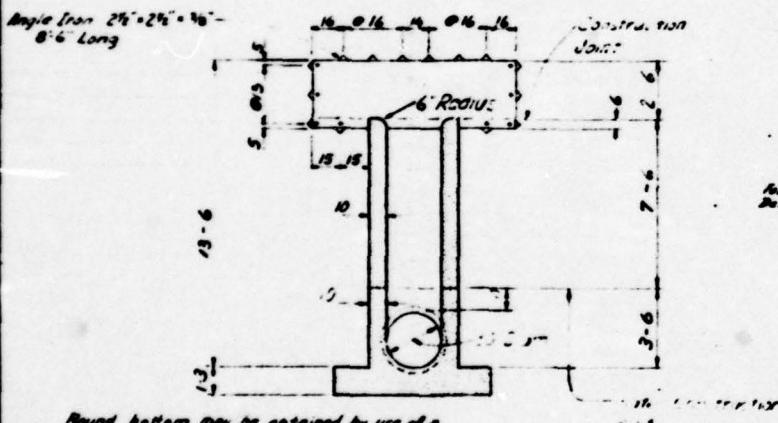


(See Detail Sheet 12)

SECTION B-B



"L" BOLT DETAIL (Spec 117, Class 303 or 302)
as Required



Round bottom may be obtained by use of a pipe cut longitudinally in half or by a removable semi-circular form; acceptable to the engineer.

SECTION A-A

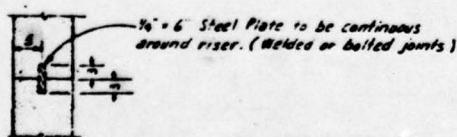


PLATE CONSTRUCTION
JOINT DETAIL —

STANDARD COVERED RISER (MODIFIED)

DESIGN CONSTANTS $f'_c = 4000 \text{ psi}$ $f_c = 1600 \text{ psi}$

STANDARD DWG. NO. EC 3030-20 E.E.

ES-3030-2013 E

Street

QUANTITIES (Riser Only)

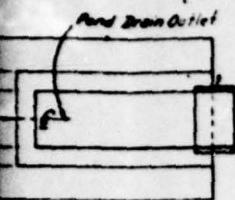
#5 Bars	—	—	1597-9	LIN. FP.	—	—	1666	LOS.
#6 Bars	—	—	413-6	LIN. FP.	—	—	621	LOS.
#7 Bars	—	—	306-0	LIN. FP.	—	—	676	LOS.
				Total	—	—	2913	OS.

Concrete

Class 400 — — — 13.9 Cy yds.

Note.
See

entes.
2. 90
2. And
3. The



SECTION - B-B

24 Pcs 5' 0"

16' 0"

Spec 117, Class 303 or 302)

→ A

Riser Crest El. 1100.00

Pond Drain Invert El. 1102.0

Riser Floor El. 1101.00
7'-0" D.P.

90 7-6
10.2
→ A

SIDE ELEVATION

(Riser Only)

1660	L.D.S.
621	L.D.S.
676	L.D.S.
2913	D.S.

STEEL SCHEDULE															
Mark	Size	Quan-	Length	Type	B	C	Total Length	Mark	Size	Quan-	Length	Type	B	C	Total Length
B1	0 6	11	6-9	1			78-3								
B2	0 6	8	9-9	1			78-0								
B3	0 7	34	9-0	21	3-0	6-0	306-0								
B4	0 6	8	9-9	1			78-0								
B5	0 6	10	6-9	1			67-6								
B6	0 6	2	2-9	1			5-6								
B7	0 5	3	7-0	21	1-1	5-11	35-0								
B8	0 6	3	7-0	21	1-1	5-11	21-0								
B9	0 5	18	7-0	21	1-1	5-11	38-0								
B10	0 6	10	6-9	1			82-6								
B11	0 5	4	3-3	1			13-0								
B12	0 6	3	2-3	1			6-9								
B13	0 5	3	2-3	1			6-9								
B14	0 5	10	5-9	21	0-6	5-3	57-6								
B15	0 5	18	6-0	21	2-9	5-3	146-0								
<hr/>															
S-1	5	14	9-9	1			136-6								
S-2	5	8	7-3	1			58-0								
S-3	5	16	8-3	1			132-0								
S-4	5	14	3-3	1			45-6								
S-5	5	10	9-9	1			115-6								
S-6	5	8	7-3	1			58-0								
S-7	5	36	8-0	21	2-9	5-3	288-0								
S-8	5	4	11-6	21	6-3	5-3	46-0								
S-9	5	16	8-9	1			140-0								
S-10	5	42	2-6	1			105-0								
S-11	5	8	3-0	1			24-0								
<hr/>															

Note.
See Sheet 13 for General Notes

BAR TYPES

STB

TYPE 1

C
TYPE 21

0 2 4 6
Scale in Feet

LITTLE SHENANGO RIVER WATERSHED
FLOODWATER RETARDING DAM PA-489
MERCER COUNTY, PENNSYLVANIA
STRUCTURAL DETAILS (RISER)

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Approved by:	Date:
R. J. MAYS	3-66
Printed:	Date:
A. Yerman	3-66
Printed:	Date:
PA-489-P	

AS BUILT PLANS
PLATE 8

ONE ORIGINALLY ISSUED DRAWING IS MAILED TO DDCI

APPENDIX A

**CHECK LIST - VISUAL INSPECTION
AND FIELD SKETCH**

Check List
Visual Inspection
Phase 1

A-1

Name of Dam	County	State	PA	Coordinates	Lat.	Long.
HADLEY DAM (PA 489)	Mercer				N 41° 25.5'	W 80° 15.1'
NDI # PA 00245						
PENNDEP # 43-52						
SCS # PA 489						

Date of Inspection 27 April 1979 Weather Overcast, Windy Temperature 50°F.

Pool Elevation at Time of Inspection 1108.7 ft.* M.S.L. Tailwater at Time of Inspection 1091.5 ft.* M.S.L.

*All elevations are referenced to the principal spillway crest (El. 1108.0 ft.)

Inspection Personnel:

Michael Baker, Jr., Inc.:

James G. Ułinski
Rodney E. Holderbaum
David Johns

Site Visit 5 June 1979

Dr. C. Y. Chen
James G. Ułinski

Owner's Representative
Mercer County Conservation District:

James Mondok (part-time)

David Johns Recorder

Name of Dam: HADLEY DAM (PA 469)

NDI # PA 00245

VISUAL EXAMINATION OF

PERMAGE

STRUCTURE TO
ABUTMENT/EMBANKMENT
JUNCTIONS

DRAING

WATER PASSAGES

FOUNDATION

CONCRETE/MASONRY DAMS - Not Applicable

A-2

REASONS OR INCONCERNATIONS

Name of Dam: HADLEY DAM (PA 489)

A-3

CONCRETE/MASONRY DAMS- Not Applicable

NDI # PA 00245

VISUAL EXAMINATION OF

OBSERVATIONS

REMARKS OR RECOMMENDATIONS

SURFACE CRACKS
CONCRETE SURFACES

STRUCTURAL CRACKING

VERTICAL AND HORIZONTAL
ALIGNMENT

MONOLITH JOINTS

CONSTRUCTION JOINTS

EMBANKMENT

Name of Dam: HADLEY DAM (PA 489)

NDI # PA 00245
VISUAL EXAMINATION OF

OBSERVATIONS

REMARKS OR RECOMMENDATIONS

SURFACE CRACKS	None observed	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed	
SLoughing or Erosion of Embankment and Abutment Slopes	<p>1. Minor sloughing has occurred at several small areas on the downstream face.</p> <p>2. Rutting has occurred along crest due to vehicular traffic.</p>	<p>1. The sloughed areas should be regraded and seeded.</p> <p>2. The ruts should be regraded, treated and seeded with an appropriate mixture to prevent erosion.</p>
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	The vertical and horizontal alignment shown on the "as built" drawings was checked by field survey and both are congruent.	
RIPRAP FAILURES	None	

Name of Dam: HADLEY DAM (PA 489)
NDI # PA 00245
VISUAL EXAMINATION OF

A-5

EMBANKMENT

OBSERVATIONS RECOMMENDATIONS

JUNCTION OF EMBANKMENT
AND ABUTMENT, SPILLWAY
AND DAM

No problems were observed.

ANY NOTICEABLE SEEPAGE A minor amount of seepage was noted to the left
of the outlet channel.

This area should be checked during
future inspections.

STAFF GAGE AND RECORDER None installed

DRAINS Two 12-in. diameter toe drainpipes, with small animal guards,
discharge from the outlet structure on either side of the outlet
pipe. Toe drains of granular material and rockfill were also
observed along portions of downstream slope junctions with both
abutments.

The drainpipes appeared to be in
operating order.

Name of Dam:	HADLEY DAM (PA 489) NDI # PA 00245	OUTLET WORKS (PRINCIPAL SPILLWAY IN SCS TERMINOLOGY)
VISUAL EXAMINATION OF	OBSERVATIONS	REASONS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Most of the outlet conduit was inaccessible. The conduit at its exit, however, appeared to be in good condition.	Debris should be removed from the structure periodically.
INTAKE STRUCTURE	A large amount of debris has collected on top of the structure. No other problems were observed.	
OUTLET STRUCTURE	The joint sealer between the outlet conduit and concrete outlet structure has deteriorated. Some minor deterioration of the concrete surfaces was also observed.	The joint sealer should be replaced. The minor deterioration of the concrete is not considered abnormal for the age of the structure.
OUTLET CHANNEL	No problems were observed.	
EMERGENCY GATE	The 24-in. diameter pond drain was bolted shut with a 1/4-in. steel plate.	

Name of Dam: MOLEY DAM (PA 489) (EMERGENCY SPILLWAY IN
MDI # PA 00245 SCS TERMINOLOGY)

VISUAL EXAMINATION OF OBSERVATIONS REMARKS OR RECOMMENDATIONS

CONTROL SECTION The control section is well vegetated and free of debris and obstructions.

APPROACH CHANNEL The approach channel is well vegetated and free of debris and erosion.

DISCHARGE CHANNEL Some settlement has occurred in the channel possibly due to transport of soil particles by groundwater movement. The settled areas should be filled and reseeded.

BRIDGE AND PIERS Not Applicable

Name of Dam: WOLEY DAM (PA 489)
NDI # PA 00245

GATED SPILLWAY - Not Applicable

A-8

VISUAL EXAMINATION OF
CONCRETE SILL

OBSERVATIONS

REMARKS OR RECOMMENDATIONS

APPROACH CHANNEL

DISCHARGE CHANNEL

BRIDGE AND PIERS

GATES AND OPERATION
EQUIPMENT

Name of Dam: HADLEY DAM (PA 489)
NDI # PA 00245

INSTRUMENTATION - None Installed
A-9

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS		

OBSERVATION WELLS

WELLS

PIEZOMETERS

OTHER

A-10

RESERVOIR

Name of Dam: HADLEY DAM (PA 489)

NDI # PA 00245

VISUAL EVALUATION OF

SLOPES

OBSERVATIONS

The reservoir slopes are generally relatively steep and consist of primarily forest and farmlands.

REMARKS OR RECOMMENDATIONS

SEDIMENTATION

Considering the age of the structure, sedimentation should be relatively insignificant.

The reservoir was designed by the SCS with allowance for 50 yrs. of sediment accumulation.

DOWNSTREAM CHANNEL

Name of Dam: MONKEY DAM (PA 489)

MDI # PA 00245

VISUAL INSPECTION OF

OBSERVATION

CONDITION
(OBSTRUCTIONS,
DEBRIS, ETC.)

REMARKS OR RECOMMENDATIONS

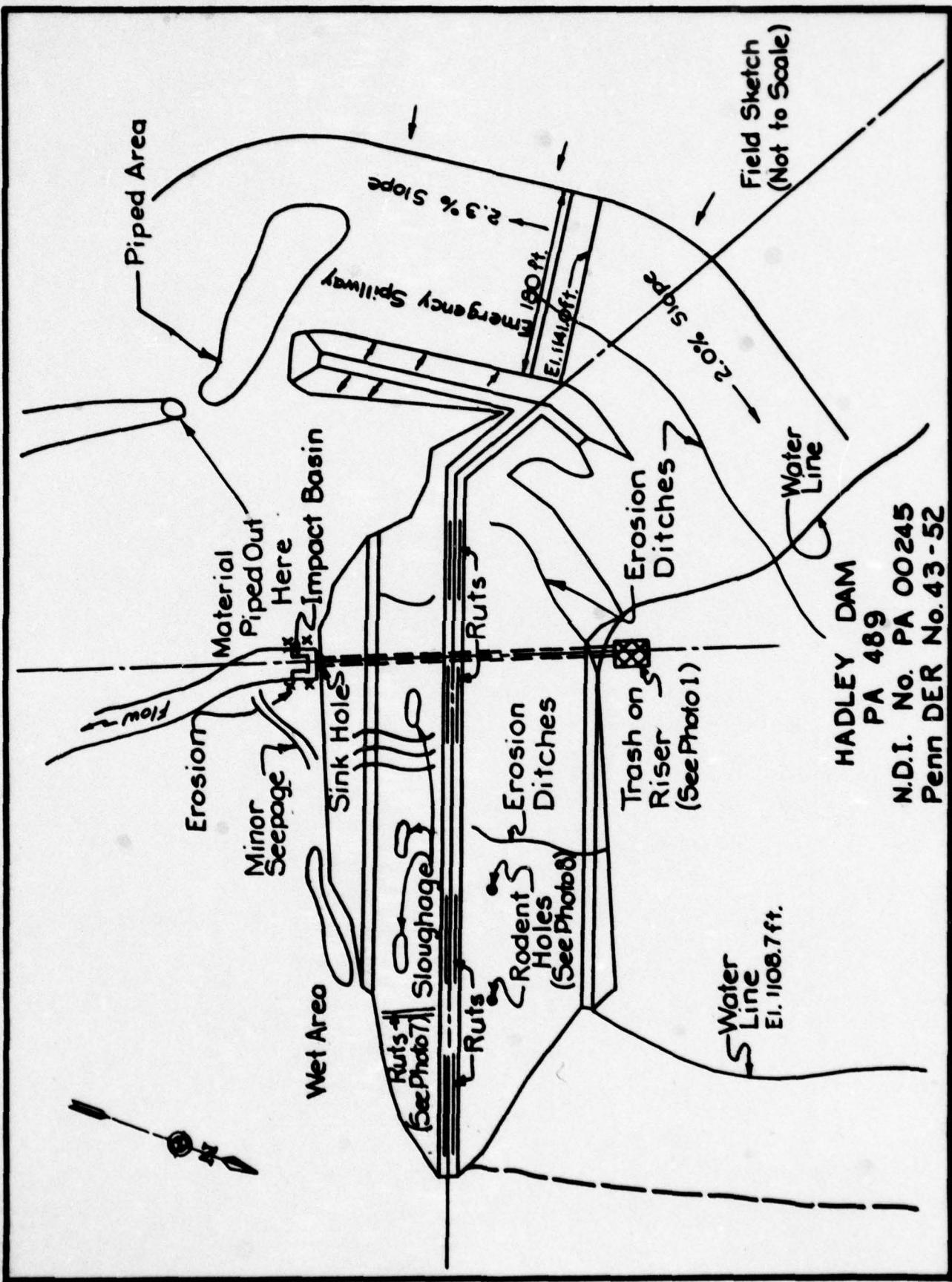
No significant obstructions are located in the downstream channel. The first half mi. of the stream downstream from the dam flows through a heavily wooded narrow stream valley. The remainder of the stream valley is wider and consists of relatively open areas.

SLOPES

The slopes immediately downstream from the dam are relatively steep. As the stream nears the confluence with the Little Shenango River, the slopes flatten out and remain moderately sloping along the entire length of the river.

APPROXIMATE NO.
OF HOMES AND
POPULATION

Two or three homes are located in low lying areas between the dam and the confluence with the Little Shenango River, a distance of approximately 1 mi. The Borough of Greenville is located approximately 10 mi. downstream from the dam.



APPENDIX B

CHECK LIST - ENGINEERING DATA

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

B-1

Name of Dam: WADLEY DAM (PA 489)
NDI # PA 00245

ITEM REMARKS

PLAN OF DAM See Plate 3, Plan of Dam Site.

REGIONAL VICINITY MAP See Plate 1, a portion of the USGS Greenville East, Pennsylvania 7.5 minute quadrangle series map showing dam location with state location inset.

CONSTRUCTION HISTORY The dam was designed by the Department of Agriculture, Soil Conservation Service (SCS) and constructed by the Foster Grading Co. of Jackson Center, Pennsylvania from June 1967 through July 1968.

TYPICAL SECTIONS OF DAM See Plate 4, Profiles of Dam and Emergency Spillway.

HYDROLOGIC/HYDRAULIC DATA SCS "Design Report Site PA-489, Little Shenango Watershed" available in PennDER's files.

- OUTLETS - PLAN See Plate 6, Plan-Profile of Principal Spillway.
- DETAILS See Plate 7, Impact Basin Details.
- CONSTRAINTS No information is readily available.
- DISCHARGE RATINGS PennDER's Dam Permit Application Report indicates a maximum outflow of 115 c.f.s. Additional information is available in the SCS "Design Report".

RAINFALL/RESERVOIR RECORDS None available

Name of Dam: HADLEY DAM (PA 489)
MDI # PA 00245

B-2

ITEM REMARKS

DESIGN REPORTS The SCS "Design Report, PA 489, Little Shenango Watershed," is available in PennDER's files.

GEOLOGY REPORTS See Appendix E.

DESIGN COMPUTATIONS
HYDROLOGY & HYDRAULICS
DAM STABILITY
SEEPAGE STUDIES

Design computations are included in the SCS "Design Report."

MATERIALS INVESTIGATIONS
BORING RECORDS
LABORATORY
FIELD

Logs of drill holes and test pits are shown on Sheets 14 to 17 of the "as built" plans.
available in PennDER's files.

POST-CONSTRUCTION SURVEYS OF DAM

Annual inspections have been made from 1970-1977 by representatives of the
Mercer County Commissioners and the SCS. Copies of the inspection reports
are available in PennDER's files.

BORROW SOURCES

Glacial soil deposits in the spillway and the reservoir areas: Plan - Reference Drawings - Sheet 2.
Boring and Test Pit Logs - Reference Drawings - Sheets 14-17 - Little Shenango River Watershed,
Floodwater Retarding Dam PA-489 Mercer County, Pennsylvania - "as built" plans. These plans are
available from PennDER's files.

Name of Dam: HADLEY DAM (PA 489)

NDI # PA 00245

ITEM _____

REMARKS _____

MONITORING SYSTEMS None

MODIFICATIONS None

HIGH POOL RECORDS No information available

POST-CONSTRUCTION ENGINEERING Annual inspection reports are available in PennDEER's files.
STUDIES AND REPORTS

PRIOR ACCIDENTS OR FAILURE OF DAM None
DESCRIPTION REPORTS

Maintenance No records are readily available.
OPERATION RECORDS

Name of Dam: HADLEY DAM (PA 489)
NDI # PA 00245

B-4

ITEM REMARKS

SPILLWAY PLAN.

SECTIONS ,
and
DETAILS See Plate 6, Plan - Profile of Principal Spillway.

OPERATING EQUIPMENT
PLANS & DETAILs

None installed

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

B-5

DRAINAGE AREA CHARACTERISTICS: 4.6 sq.mi. (primarily farmland)

ELEVATION TOP SEDIMENT POOL (STORAGE CAPACITY): 1108.0 ft. (25 ac.-ft.)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 1141.0 ft. (568 ac.-ft.)

ELEVATION MAXIMUM DESIGN POOL: 1146.0 ft.

ELEVATION TOP DAM: 1148.5 ft.

CREST: (SCS Terminology - Emergency Spillway)

- a. Elevation El. 1141.0 ft. (control section)
- b. Type Vegetated earth channel, curved in plan
- c. Width 180 ft.
- d. Length 600 ft.
- e. Location Spillover Right abutment
- f. Number and Type of Gates None

OUTLET WORKS: (SCS Terminology - Principal Spillway)

- a. Type Reinforced concrete riser and 30-in. diameter reinforced concrete outlet pipe
- b. Location Approximately 630 ft. from left abutment
- c. Entrance Inverts El. 1108.0 ft.
- d. Exit inverts El. 1090.42 ft.
- e. Emergency draindown facilities Pump water into low-level inlet.
(Steel plate bolted on end of pond drainpipe, entrance invert
El. 1102.0 ft.)

HYDROMETEOROLOGICAL GAGES: None

- a. Type
- b. Location
- c. Records

MAXIMUM NON-DAMAGING DISCHARGE Unknown

APPENDIX C

PHOTOGRAPHS

DETAILED PHOTOGRAPH DESCRIPTIONS

Overall View of Dam from Left Abutment

Photo 1 - Intake Riser Assembly Covered with Debris

Photo 2 - Outlet Structure

Photo 3 - View of Reservoir Area Taken from Upstream Face of Dam

Photo 4 - View of Exit Channel Taken from Outlet Works

**Photo 5 - Emergency Spillway Looking Toward Exit Channel
(Embankment Is to the Left.)**

**Photo 6 - Emergency Spillway Looking Toward Reservoir
(Embankment Is to the Right.)**

**Photo 7 - Ruts on Downstream Face of Dam
(Ruts Are Due to Four-Wheel Drive Vehicle;
See Field Sketch for Location.)**

**Photo 8 - Groundhog Burrow on Upstream Face of Dam
(See Field Sketch for Location.)**

Note: Photographs were taken on 27 April 1979.

HADLEY DAM

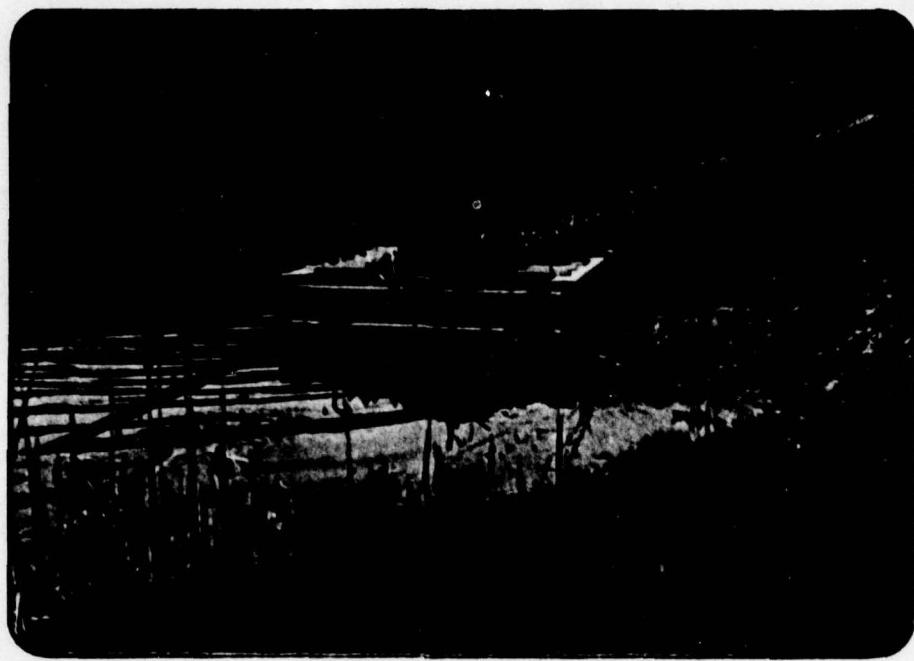


PHOTO 1. Intake Riser Assembly Covered with Debris



PHOTO 2. Outlet Structure

HADLEY DAM

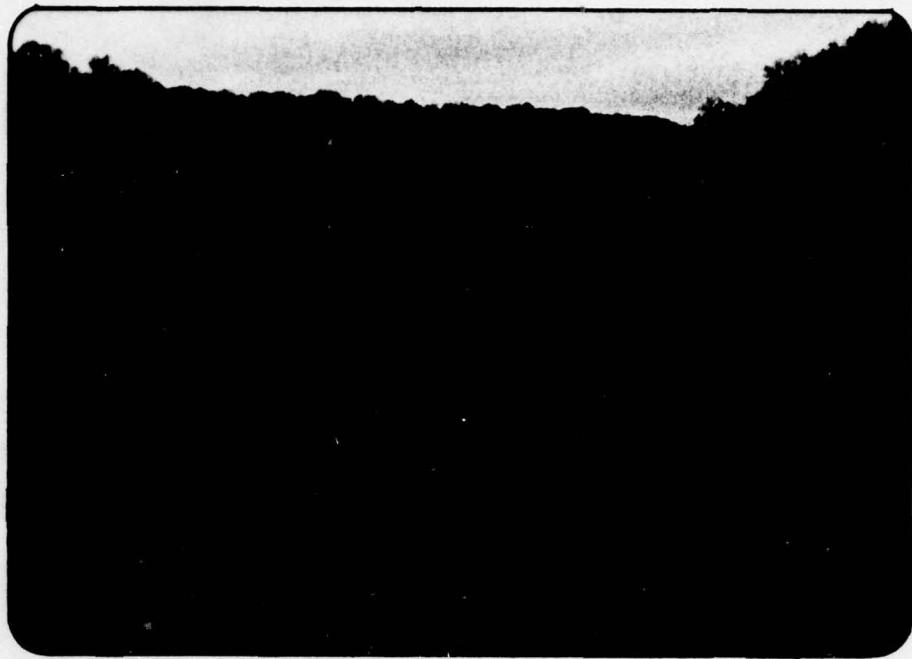


PHOTO 3. View of Reservoir Area Taken from Upstream Face of Dam

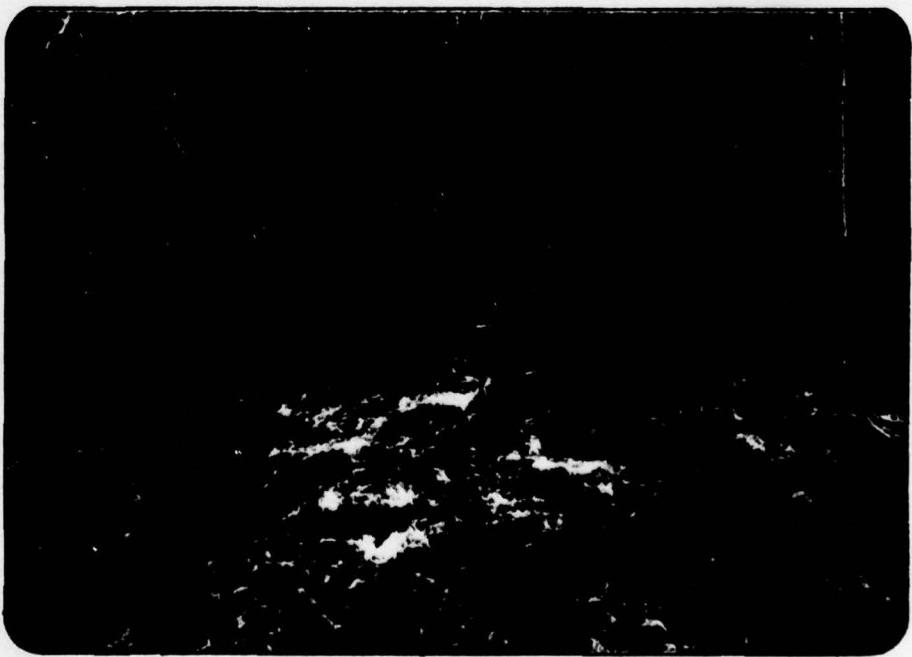
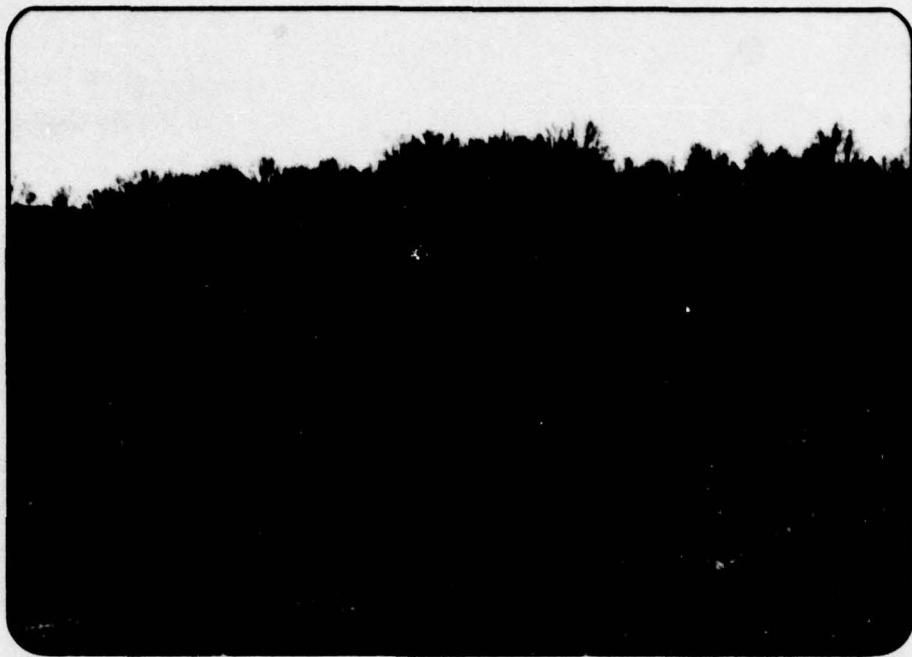
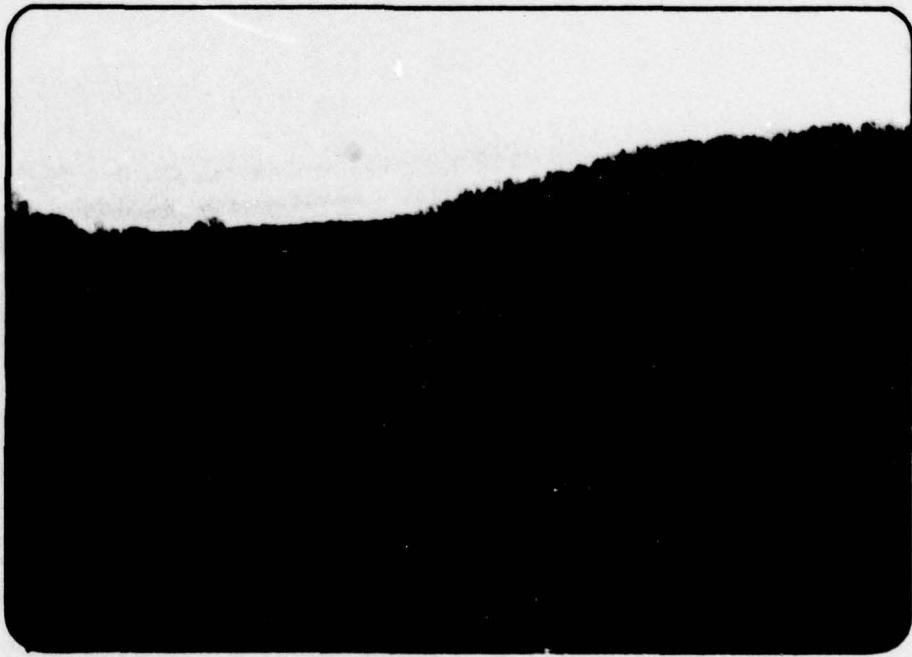


PHOTO 4. View of Exit Channel Taken from Outlet Works

HADLEY DAM



**PHOTO 5. Emergency Spillway Looking toward Exit Channel
(Embankment is to the left.)**



**PHOTO 6. Emergency Spillway Looking toward Reservoir
(Embankment is to the right.)**

HADLEY DAM

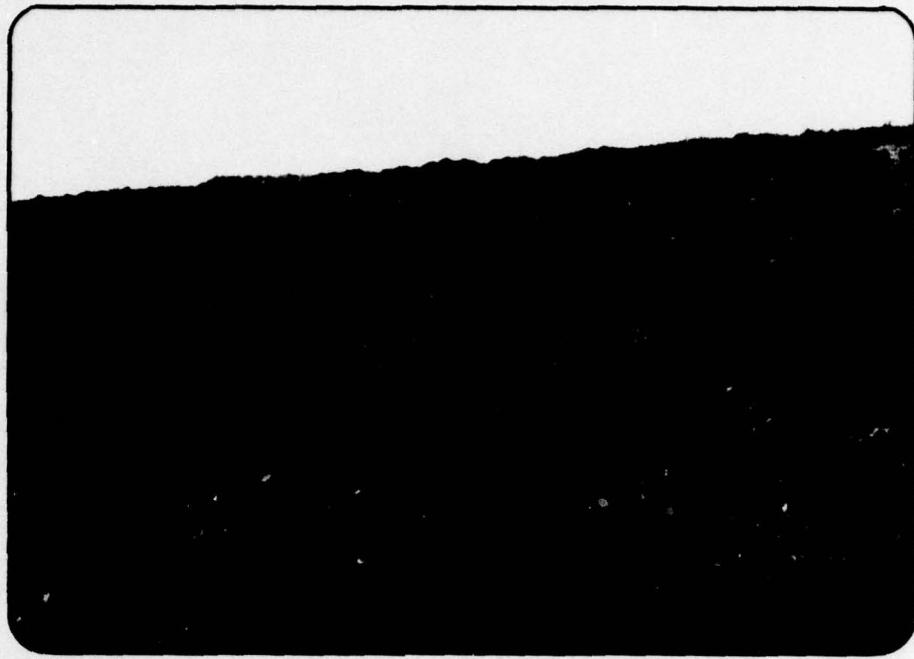
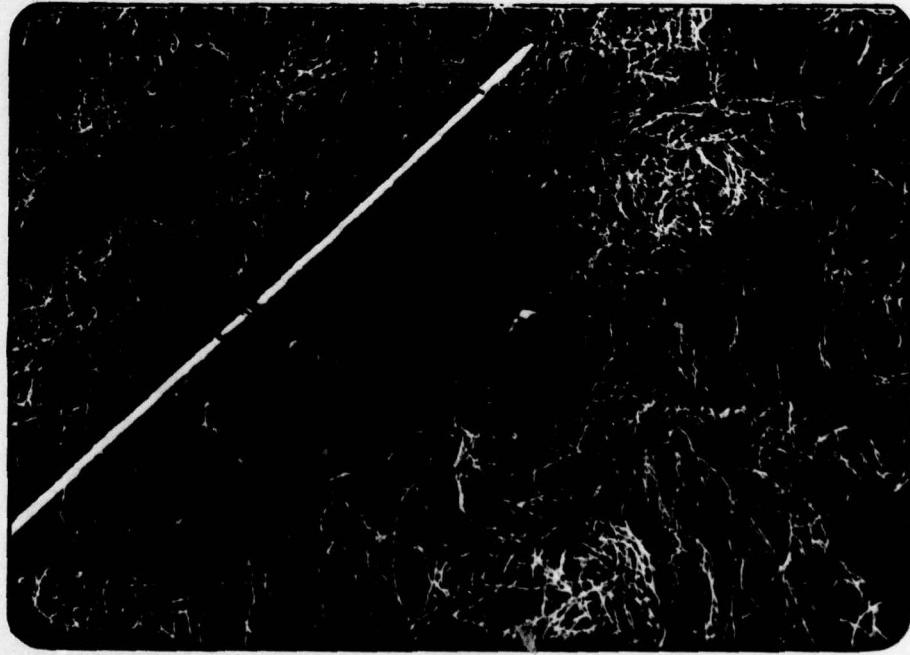


PHOTO 7. Ruts on Downstream Face of Dam (Ruts due to four-wheel drive vehicle; see field sketch for location.)



**PHOTO 8. Groundhog Burrow on Upstream Face of Dam
(See field sketch for location.)**

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject: HADLEY DAM (PA. NO. 489) S.O. No. _____

Sheet No. _____ of _____

Drawing No. _____

Computed by _____ Checked by _____ Date _____

TABLE OF CONTENTS

<u>SUBJECT</u>	<u>PAGE</u>
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WATERSHED PLAN	2
STAGE VS. STORAGE, AREA	3
STAGE VS. DISCHARGE	4
TOP OF DAM PROFILE	5
MAP OF DOWNSTREAM AREA	6
COMPUTER ANALYSIS (HEC-I)	7

PREFACE

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

The hydrologic determinations presented in this Phase I Inspection Report are based on the use of a Snyder's unit hydrograph developed by the U.S. Army Corps of Engineers. Due to the limited number of gaging stations available in this hydrologic region and the wide variation of watershed slopes, the Snyder's coefficients may yield results of limited accuracy for this watershed. As directed however, a further refinement of these coefficients is beyond the scope of this Phase I Investigation.

In addition, the conclusions presented pertain to present conditions, and the effect of future development on the hydrology has not been considered.

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject HADLEY DAM (PA. NO. 489) S.O. No. _____
RAINFALL AND HYDROLOGIC DATA Sheet No. 1 of 11

Computed by J.C.S. Checked by REH Drawing No. _____
Date 3-19-79

RAINFALL DATA DRAINAGE IS LOCATED IN ZONE 2

AS DRA. IS LESS THAN 10 mi^2 USE
 $10 \text{ mi}^2 \%$ P 24-300

$$P_{24 \text{ HR}} = 300 \text{ mi}^2 = 23.4 \text{ in.}$$

$$P(6 \text{ HR}) = 117\%$$

$$P(12 \text{ HR}) = 127\%$$

$$P(24 \text{ HR}) = 141\%$$

$$P(48 \text{ HR}) = 151\%$$

HYDROLOGIC DATA DRAINAGE AREA IS LOCATED IN ZONE 27,

$$CD = 0.40, CE PLATE 0$$

$$EP = 2T(L \times LCA)^{0.5}$$

$$TR = 20 \text{ MIN.}$$

$$L = 3.77 \text{ MI.}$$

$$LCA = 1.51 \text{ MI.}$$

$$EP = 2T(L \times LCA)^{0.5}$$

$$EP = 2T(3.77 \times 1.51)^{0.5}$$

$$EP = 4.60 \text{ HRS.}$$

$$TR = EP/5.5.$$

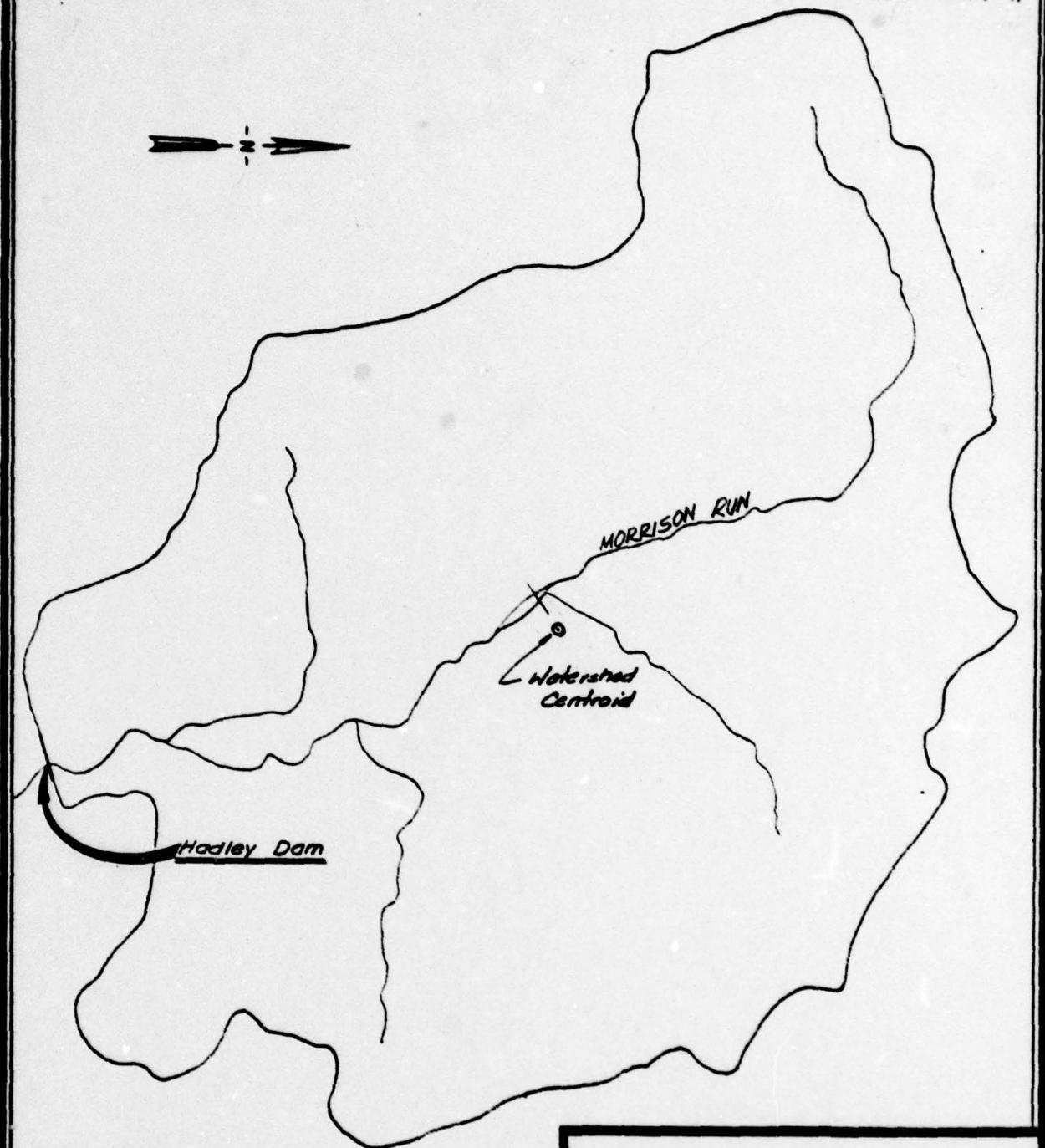
$$TR = 4.60/5.5$$

$$TR = 0.84 \text{ HR.}$$

$$TFR = EP + 0.25(TR - tr)$$

$$TFR = 4.60 + 0.25(\frac{22}{60} - 0.84)$$

$$TFR = 4.47 \text{ HRS.}$$



QUADS:
GREENVILLE EAST & HADLEY
DRAINAGE AREA: 0.58 SQ. MI.
 $L = 3.8 \text{ MI.}$ $L_{ca} = 1.6 \text{ MI.}$
0 2000 4000
SCALE IN FEET

DATE: 5-16-79

HADLEY DAM
WATERSHED MAP

MICHAEL BAKER JR. INC.
Consulting Engineers & Surveyors

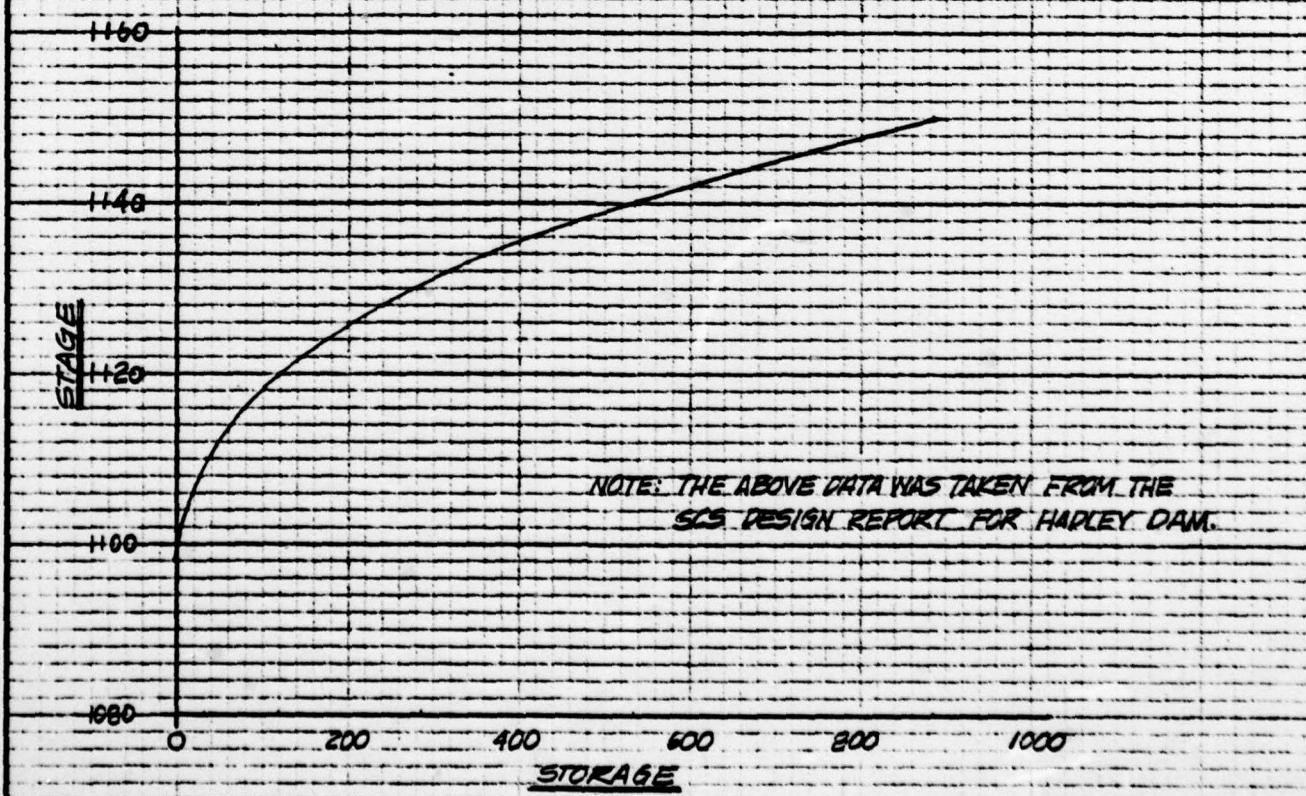
MICHAEL BAKER, JR., INC.
| THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject HADLEY DAM (PA. NO. 489) S.O. No. _____
STAGE VS. STORAGE, AREA Sheet No. 3 of 11
Drawing No. _____
Computed by J. G. S. Checked by REH Date 3-19-79

* FROM DESIGN DATA (SCS DESIGN REPORT)

STAGE (FE)	STORAGE (AC. FT.)	AREA (AC.)
1098	0	0
1110	31	6.0
1120	119	11.6
1130	284	21.3
1140	533	28.6
1150	885	42.0



NOTE: THE ABOVE DATA WAS TAKEN FROM THE
SCS DESIGN REPORT FOR HADLEY DAM.

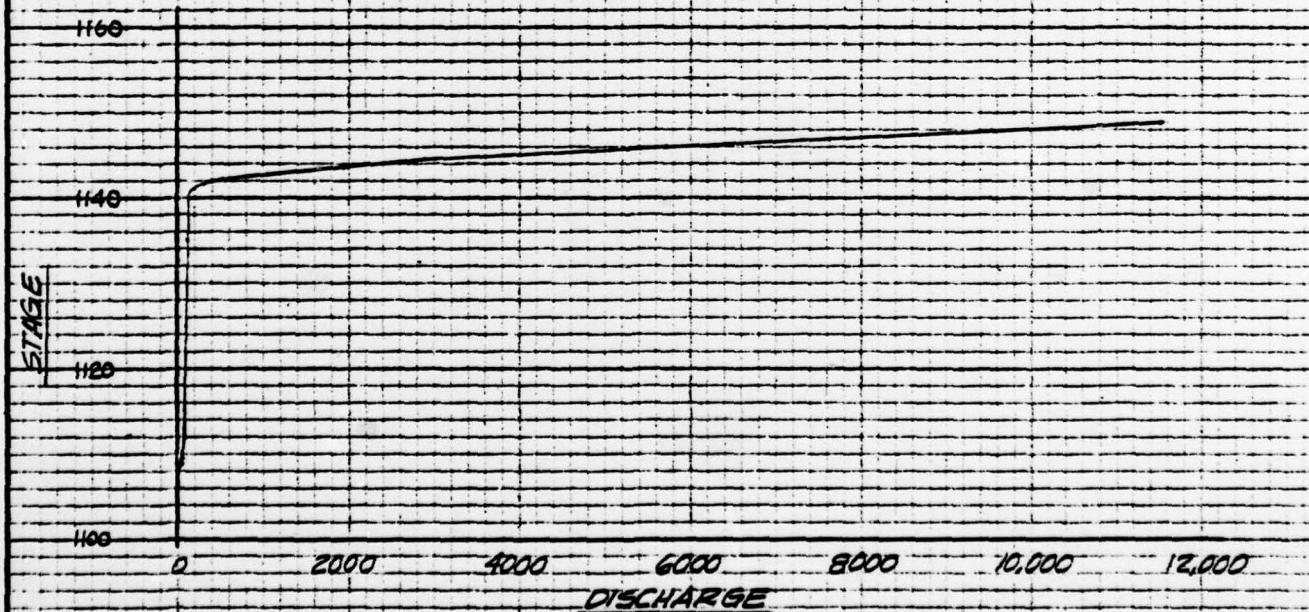
MICHAEL BAKER, JR., INC.
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Beaver, Pa. 15009

Subject HADLEY DAM (PA. NO. 489) S.O. No. _____
STAGE VS. DISCHARGE Sheet No. 4 of 11

Computed by J.G.S. Checked by REH Drawing No. _____
Date 3-19-79

STAGE (ft)	DISCHARGE(cfs)	STAGE (ft)	DISCHARGE(cfs)
1108.0	0	1135.0	111
1108.5	15	1141.0	119.
1108.6	20	1142.8	1030
1109.0	43	1143.1	1951
1109.5	68	1144.4	2880
1112.0	74	1145.0	3816
1113.0	79	1146.1	5108
1120.0	88	1147.1	7622
1123.0	96	1148.0	9557
1130.0	104	1148.8	11,504

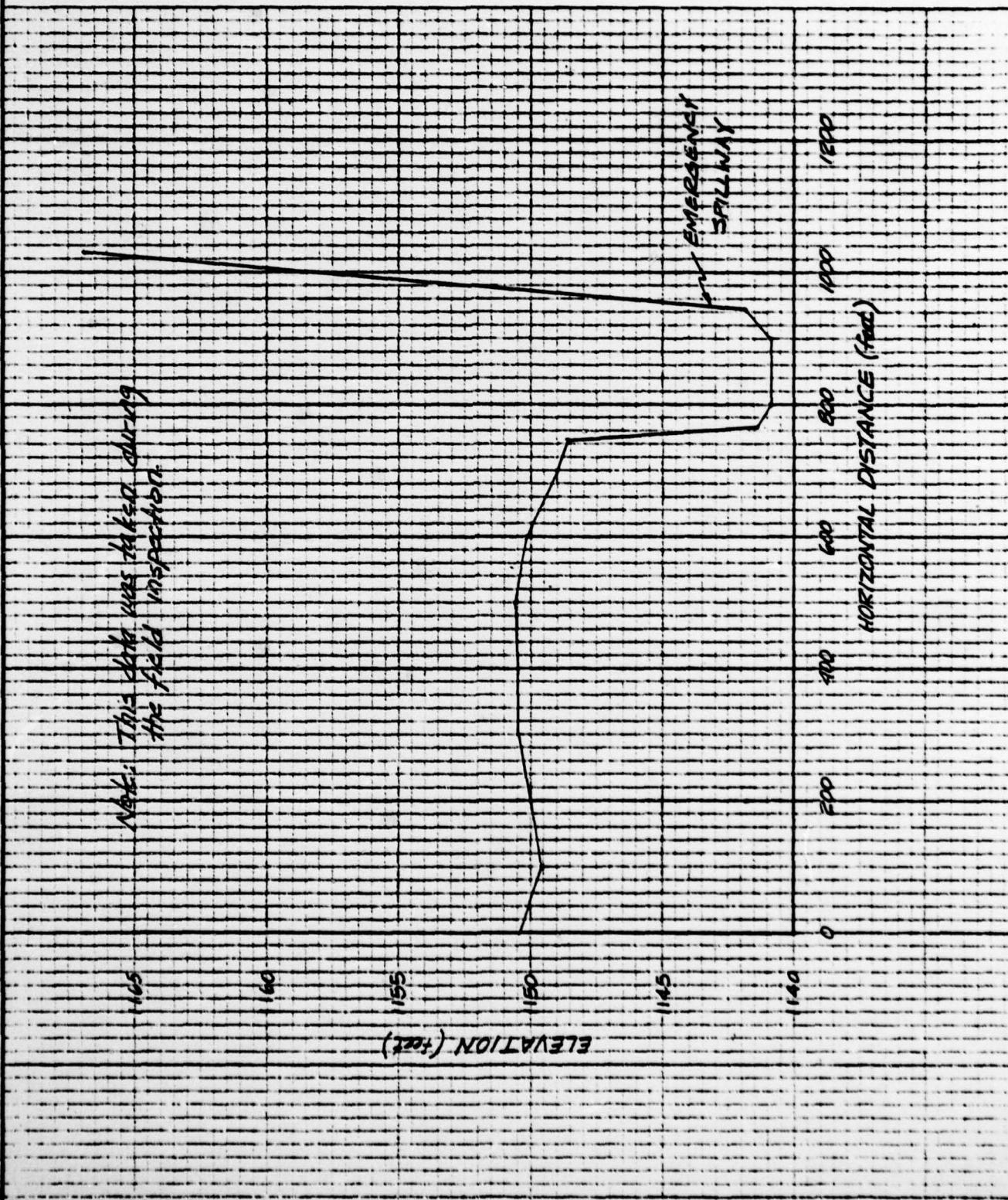


NOTE: THE ABOVE DATA WAS TAKEN FROM THE SCS DESIGN
REPORT FOR HADLEY DAM.

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject HADLEY DAM S.O. No. _____
TOP OF DAM PROFILE Sheet No. 5 of 11
Computed by SCB Checked by _____ Drawing No. _____
Date 5-15-79

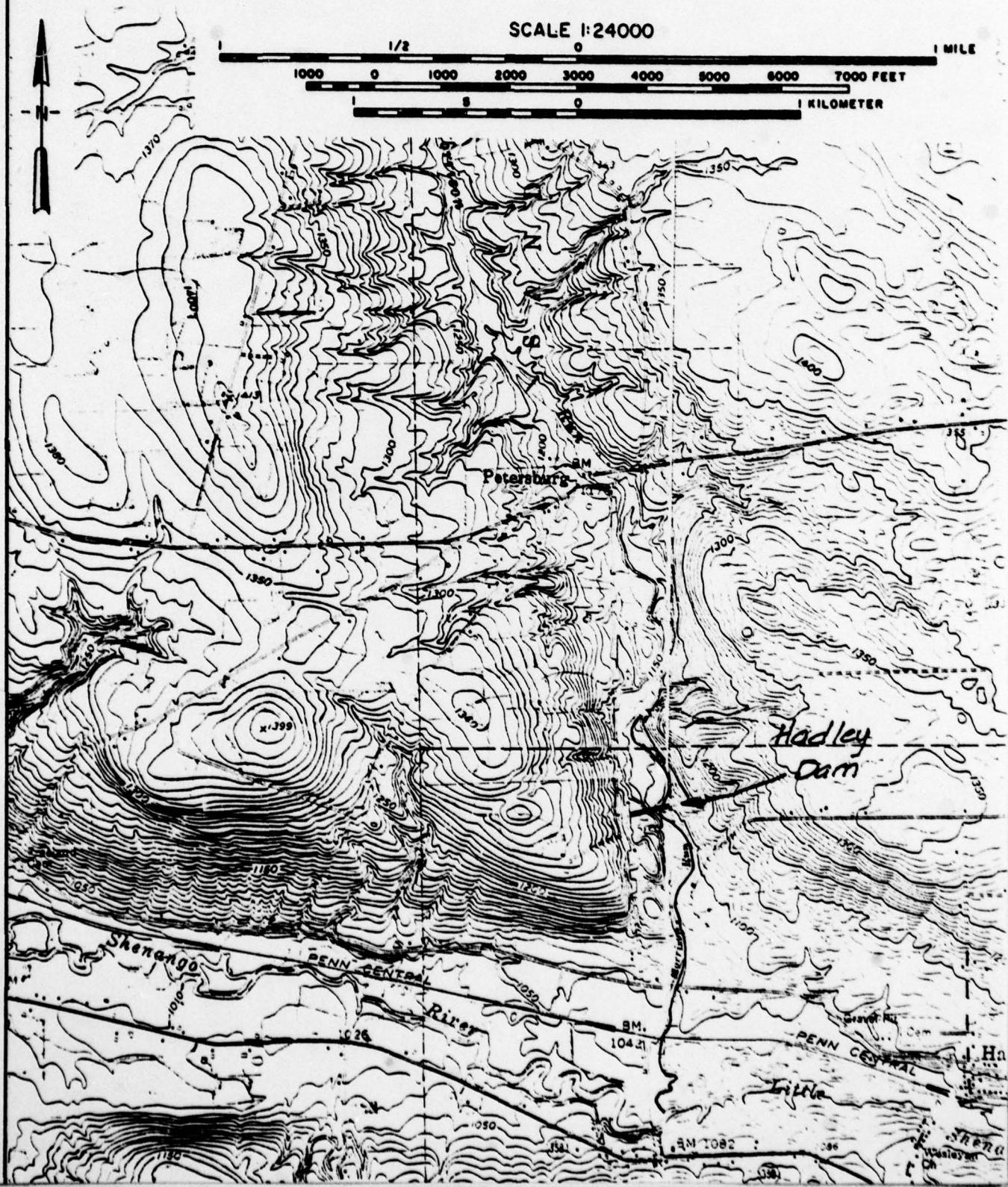


MICHAEL BAKER, JR., INC.
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Beaver, Pa. 15009

Subject Hadley Dam S.O. No. _____
Map of Downstream Area Sheet No. 6 of 11

Computed by SCB Checked by REH Drawing No. _____
Date 6-15-79



FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION JULY 1978
 LAST MODIFICATION 26 FEB 79
 MBJ UPDATE 34 JUN 79

NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
 HYDROLOGIC AND HYDRAULIC ANALYSIS OF PA 46, MBJ 11
 PREPARED MAXIMUM FLOOD PFM/UNIT GRAPH BY SURVEKS METHOD

	A1	A2	A3	B1	B2	C1	C2	D1	D2	E1	E2	F1	F2	G1	G2	H1	H2	I1	I2	J1	J2	K1	K2	L1	L2	M1	M2	N1	N2	O1	O2	P1	P2	Q1	Q2	R1	R2	S1	S2	T1	T2	U1	U2	V1	V2	W1	W2	X1	X2	Y1	Y2	Z1	Z2	A4	B4	C4	D4	E4	F4	G4	H4	I4	J4	K4	L4	M4	N4	O4	P4	Q4	R4	S4	T4	U4	V4	W4	X4	Y4	Z4	A5	B5	C5	D5	E5	F5	G5	H5	I5	J5	K5	L5	M5	N5	O5	P5	Q5	R5	S5	T5	U5	V5	W5	X5	Y5	Z5	A6	B6	C6	D6	E6	F6	G6	H6	I6	J6	K6	L6	M6	N6	O6	P6	Q6	R6	S6	T6	U6	V6	W6	X6	Y6	Z6	A7	B7	C7	D7	E7	F7	G7	H7	I7	J7	K7	L7	M7	N7	O7	P7	Q7	R7	S7	T7	U7	V7	W7	X7	Y7	Z7	A8	B8	C8	D8	E8	F8	G8	H8	I8	J8	K8	L8	M8	N8	O8	P8	Q8	R8	S8	T8	U8	V8	W8	X8	Y8	Z8	A9	B9	C9	D9	E9	F9	G9	H9	I9	J9	K9	L9	M9	N9	O9	P9	Q9	R9	S9	T9	U9	V9	W9	X9	Y9	Z9	A10	B10	C10	D10	E10	F10	G10	H10	I10	J10	K10	L10	M10	N10	O10	P10	Q10	R10	S10	T10	U10	V10	W10	X10	Y10	Z10	A11	B11	C11	D11	E11	F11	G11	H11	I11	J11	K11	L11	M11	N11	O11	P11	Q11	R11	S11	T11	U11	V11	W11	X11	Y11	Z11	A12	B12	C12	D12	E12	F12	G12	H12	I12	J12	K12	L12	M12	N12	O12	P12	Q12	R12	S12	T12	U12	V12	W12	X12	Y12	Z12	A13	B13	C13	D13	E13	F13	G13	H13	I13	J13	K13	L13	M13	N13	O13	P13	Q13	R13	S13	T13	U13	V13	W13	X13	Y13	Z13	A14	B14	C14	D14	E14	F14	G14	H14	I14	J14	K14	L14	M14	N14	O14	P14	Q14	R14	S14	T14	U14	V14	W14	X14	Y14	Z14	A15	B15	C15	D15	E15	F15	G15	H15	I15	J15	K15	L15	M15	N15	O15	P15	Q15	R15	S15	T15	U15	V15	W15	X15	Y15	Z15	A16	B16	C16	D16	E16	F16	G16	H16	I16	J16	K16	L16	M16	N16	O16	P16	Q16	R16	S16	T16	U16	V16	W16	X16	Y16	Z16	A17	B17	C17	D17	E17	F17	G17	H17	I17	J17	K17	L17	M17	N17	O17	P17	Q17	R17	S17	T17	U17	V17	W17	X17	Y17	Z17	A18	B18	C18	D18	E18	F18	G18	H18	I18	J18	K18	L18	M18	N18	O18	P18	Q18	R18	S18	T18	U18	V18	W18	X18	Y18	Z18	A19	B19	C19	D19	E19	F19	G19	H19	I19	J19	K19	L19	M19	N19	O19	P19	Q19	R19	S19	T19	U19	V19	W19	X19	Y19	Z19	A20	B20	C20	D20	E20	F20	G20	H20	I20	J20	K20	L20	M20	N20	O20	P20	Q20	R20	S20	T20	U20	V20	W20	X20	Y20	Z20	A21	B21	C21	D21	E21	F21	G21	H21	I21	J21	K21	L21	M21	N21	O21	P21	Q21	R21	S21	T21	U21	V21	W21	X21	Y21	Z21	A22	B22	C22	D22	E22	F22	G22	H22	I22	J22	K22	L22	M22	N22	O22	P22	Q22	R22	S22	T22	U22	V22	W22	X22	Y22	Z22	A23	B23	C23	D23	E23	F23	G23	H23	I23	J23	K23	L23	M23	N23	O23	P23	Q23	R23	S23	T23	U23	V23	W23	X23	Y23	Z23	A24	B24	C24	D24	E24	F24	G24	H24	I24	J24	K24	L24	M24	N24	O24	P24	Q24	R24	S24	T24	U24	V24	W24	X24	Y24	Z24	A25	B25	C25	D25	E25	F25	G25	H25	I25	J25	K25	L25	M25	N25	O25	P25	Q25	R25	S25	T25	U25	V25	W25	X25	Y25	Z25	A26	B26	C26	D26	E26	F26	G26	H26	I26	J26	K26	L26	M26	N26	O26	P26	Q26	R26	S26	T26	U26	V26	W26	X26	Y26	Z26	A27	B27	C27	D27	E27	F27	G27	H27	I27	J27	K27	L27	M27	N27	O27	P27	Q27	R27	S27	T27	U27	V27	W27	X27	Y27	Z27
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Sheet 8 of 11

FLOOD HYDROGRAPH PACKAGE (HFEP-1)
DAM SAFETY VERSION 1978
LAST MODIFICATION 26 FEB 79
MHJ UPDATE 04 JUN 79

RUN DATE 06/18/79
TIME 09.14

NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
HYDROLOGIC AND HYDRAULIC ANALYSIS OF PA 489 MBJ 11
PROBABLE MAXIMUM FLOOD PFM/UNIT GRAPH BY SNYDER'S METHOD

JOB SPECIFICATION							
NO	NHR	NMIN	IDAY	IHR	IMIN	MERC	IPLT
300	0	20	0	0	0	J	0
						LROPT	JPACE
				5	0	J	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRATIO= 1 LATIO= 1

RTIOS= 1.00

SUB-AREA RUNOFF COMPUTATION

SNYDER'S UNIT HYDROGRAPH FOR HADLEY DAM

ISTAW	ICOMP	ICOND	ITAPE	JPLT	JPT	I NAME	I STAGE	I AUTO
1	C	0	0	0	0	1	0	0

IHYD	IUNG	TAREA	SNAF	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LCAL
1	1	4.58	0.0	4.58	0.0	0.0	0	0	0

SPFE PMS R6 R12 R24 R48 R72 R96
0.0 23.40 117.00 127.00 141.00 151.00 0.0 0.0

TP= 4.47 CP=0.40 NTA= 0
LPOPT STRKR DLTMR RTICL ERAIN SIRKS RTDCK STRIL CNSIL ALSMX RTIMP
0 0.0 0.0 1.00 0.0 0.0 1.00 0.0 0.0 U.U U.U

STRTQ= -1.50 QRCMN= -0.05 RTIOR= 2.00

UNIT HYDROGRAPHIC END-OF-PERIOD COORDINATES, LAG= 4.49 HOURS, CP= 0.40 VUL= 0.58
5. 18. 37. 60. 87. 115. 145. 176. 204. 246. 260. 269. 271. 266. 254. 244. 234. 226. 208. 200. 192. 184. 177. 170. 164. 157. 151. 139. 134. 129. 124. 119. 114. 110. 105. 101.

Sheet 9 of 11

93.	90.	86.	83.	80.	77.	74.	71.	68.	65.
63.	60.	58.	56.	53.	51.	49.	47.	46.	44.
42.	40.	39.	37.	36.	34.	33.	32.	31.	29.
28.	27.	26.	25.	24.	23.	22.	21.	20.	19.
19.	18.	17.	16.	15.	15.	14.	14.	13.	13.
13.	12.	12.	11.	11.	10.	10.	10.	9.	9.

W₀ HR.MR. PERIOD RAIN EXCS LOSS COMP Q END-OF-PERIOD FLC₀ M₀.UA HR.MN PERIOD RAIN EXCS LOSS COMP G

SUM 26.27 27.83 2.44 2224.0.
(718.16 626.11 62.31 6379.92)

HYDROGRAPH ROUTING

THIS IS A ROUTING FOR FACILEY DAM

ISTAG DAM	ICOMP 1	IECON C	ITAPE 0	JPLI 0	JPKT 0	I NAME I	ISATE 0	IAUT 0
LOSS 0.0	CLOSS 0.0	Avg 0.0	ROUTING DATA 1	IGPT 1	IPMP 0	LSTK 0		
	MSTPS	MSTOL	LAG 0	AMSKX 0	TSA 0	STOR 0	ISPHAT -1	
	1	0	0	0.0	0.0	-11.00		
STAGE 1105.00 1135.00	1108.50 1141.00	1108.60 1142.80	1109.00 1143.70	1109.50 1144.40	1112.00 1145.00	1112.00 1146.10	1142.00 1147.10	1130.00 1148.00
FLOW 111.00	0.0 119.00	15.00 1030.00	20.00 1951.00	43.00 2680.00	68.00 3616.00	74.00 7408.00	98.00 7622.00	104.00 9527.00
CAPACITY=	0.	31.	115.	264.	533.	445.		
EL ELEVATION=	1098.	1110.	1120.	1130.	1140.	1150.		
	CPEL 1106.0	SPWID 0.0	COVM 0.0	FPPM 0.0	ELEV 0.0	COUL 0.0	CAREA 0.0	EXPL 0.0
					DAM DATA	DAM ID		
					TOPEL 1148.7	COUD 2.0	DAMID 1.5	750.

PEAK OUTFLOW IS 5601. AT TIME 44.33 HCURS

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	ARFA	PLAN	RATIO	1	RATIOS APPLIED TO FLOWS
HYDROGRAPH AT	1	4.58	1	5410.	(153.43)(
ROUTE TO	DAM	4.58	1	5401.	(152.94)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1	ELEVATION STORAGE OUTFLOW	INITIAL VALUE	SPILLWAY CREST	MINIMUM		
				MAXIMUM DEPTH OVER CAM	MAXIMUM STORAGE AC-FT	DURATION OVER TCP HOURS
1.00	1145.92	6.0	761.	5401.	0.0	44.33

APPENDIX E

REGIONAL GEOLOGY

HADLEY DAM (PA 489)
NDI No. PA 00245, PennDER No. 43-52, SCS No. PA 489

REGIONAL GEOLOGY

Bedrock units along Morrison Run, the location of Hadley Dam, are relatively flat-lying members of the Cuyahoga group, Mississippian system. The Sharpsville sandstone, generally fine-grained sandstone and dark gray shale and siltstone is the predominant member in the reservoir and dam area. Geologic references show numerous fracture traces in the area surrounding the reservoir. The geologic report made for design of the dam indicates variable bedrock permeability rates with "vertical fractures" in one of the borings.

This section of the Appalachian Plateaus physiographic province has been glaciated, resulting in deposits of glacial till of variable thickness; on the floor of the valley the sands and silts were only about 5 to 7 feet thick whereas on the sides of the valley the glacial deposits of sand, silt and gravel are up to 45 feet thick. In addition to these glacial soils, there were some recent alluvium and colluvium at the dam site.

The geologic map and legend on the following page show the relationship of the dam to regional geology.



LEGEND



SHENANGO FORMATION

The upper member (Msu) is composed of soft medium- to dark-gray shale with interbeds of siltstone and lenses of fine-grained sandstone. Unimportant as an aquifer. The lower member (MsI) is composed of medium- to fine-grained light-gray sandstone and medium- to dark-gray shale and siltstone. Yields moderate to large quantities of water that is locally high in iron content at shallow depths.



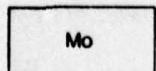
MEADVILLE SHALE

Medium- to dark-gray shale, siltstone, and lenses of fine-grained sandstone and occasional thin beds of limestone. Generally yields sufficient water for domestic and stock use.



SHARPSVILLE SANDSTONE

Very fine grained, light-gray sandstone and medium- to dark-gray shale and siltstone. Yields small to large quantities of water. Largest yields are obtained in the Shenango 15' quadrangle; locally contains saline water.



ORANGEVILLE SHALE

Dark-gray shale, occasionally containing some thin siltstone beds. Unimportant as an aquifer.

MISSISSIPPIAN }
Cuyahoga Group }